# OPERATIONS MANUAL

## Automatic Tank Gauging (ATG)

## System RTU Type System

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# 1 System Overview

## 1.1 Introduction

The ALSTOM automatic tank gauging (ATG) system is a state-of-the-art, modularized data acquisition and storage system designed to monitor a number of fuel storage tank parameters using industrial standard components.

ALSTOM designed the ATG System to take advantage of proven commercial components that are readily available. This concept insures availability of spare parts, and easy and economical maintenance and training services. Maximizing the use of these standard commercial components will ultimately lead to lower life cycle costs for the system, particularly for products that are manufactured in high volume with worldwide availability.

The following major standard commercial components are included in the ATG System supplied by ALSTOM:

- ENRAF Gauges and Temperature Probes
- Coggins Systems Remote Terminal Unit and Fuels Manager Software
- Endress+Hauser Density Probes

The system was created by a cooperation of ALSTOM, Whessoe Coggins Systems and ENRAF.

### ALSTOM

ALSTOM Systems and Automation, formerly known as AEG and CEGELEC AEG was founded over 150 years ago and was always a leader in technical development on either High Power or Information electrical technology. The ALSTOM Systems and Automation Division, headquartered in Frankfurt, Germany, is an industrial supplier for the oil and gas industry as well as for Automotive Industries, Transportation etc. Since 1968 the Refueling Systems Department is a major supplier for the United States Air Force Europe and international commercial and governmental customers.

### Coggins Systems

Coggins Systems, located in Norcross (Atlanta), GA, is a member of the Whessoe Group with Headquarters in the United Kingdom. Coggins Systems is essentially a software manufacturer and provides the Remote Terminal Unit (RTU) and software for the Control system. The Company has a long term relationship with the Department of Defense and provides the Fuels Manager Software under a Government license.

### ENRAF

ENRAF, Inc. has been active in the manufacturing of Automatic Tank Gauging on a worldwide basis for over 40 years. With direct offices in the

United States, the Netherlands, UK, Germany, France and Singapore, and with a network of over 75 qualified distributors, they provide both applications and after-sale support for our complete range of products. ENRAF has placed more than 45,000 Automatic Tank Gauging instruments in service.

#### ENDRESS+HAUSER

ENDRESS+HAUSER is a renown Swiss company with manufacturing facilities located in Germany. The company provides a multitude of density and measurement probes worldwide .

## 1.2 Overview "Automatic Tank Gauging"

#### Automatic Tank Inventory, 24h a day, 7 days a week

Instead of manually measuring the tank level each day, the tank inventory is provided by the system on a continuous, real-time basis.

#### Overview within seconds, performed by a single operator, Worldwide transfer of tank data

Only one operator is needed to obtain a total tank inventory on base. Additionally, as all systems are connected to the Military Internet Section, a centrally located server at DFSC is able to read the tank data of all connected bases worldwide. The operation is kept as simple as possible so no extensive computer training is required to use the system. Once the system is set up, the actual inventory is available by a single Mouse click.

#### Event logging and real-time alarming

To enable the administrator checking on events which happened in the past, all alarms and events are stored into a log-file. This contains information about alarms (e.g. High Level Alarms), events (e.g. Logging in of an operator) or others (e.g. Acknowledging of an Alarm including logging the name, date and time of the incident).

## 1.3 Technical Features of the ATG

The type of gauge used is dependent on the tank size. An ENRAF 854 Servo-Gauge is used for large tanks, and an ENRAF STIC 818 capacitive gauge is used for small tanks.

Both units are connected to the remote telemetry station Whessoe Coggins RTU (Remote Telemetry Unit) by means of serial communication links. The RTU controls the measuring procedures and the data communications to and from the tank gauges. Selected tank data can be indicated on a local display (LDU - Local Display Unit) placed near the RTU.

All RTUs at an installation are connected to the ATG system by either a telephone cable or by wireless radio channel system. The ATG Main Computer communicates to the RTU through either medium and controls the data exchange.

The ATG control computer collects and processes all the data from the various tanks and is able to provide that information in different reports for individual tanks, for a specific products or for a group of tanks.

### Capacitive (STIC) Gauge on Type I Tanks (<= 55,000 U.S. Gallons)

An ENRAF STIC 818 capacitive type gauge is used for the small tanks. This gauge has no moving parts or shock sensitive devices. The Gauge provides continuous real time measurement of product, water levels and temperature. The Density is measured by two separate pressure probes mounted into the tank adjacent to the gauge. The STIC Gauge is restricted to tanks with a maximum of 12' in height.

### Servo Gauges on Type II Tanks (>55,000 U.S. Gallons)

For larger tanks a highly integrated ENRAF 854 Servo gauge is used. The Gauge provides continuous real-time measurement of the fuel level and can provide immediate water and density values on demand.

### Independent Data Collection Points (DCP) with Local Display Units (LDU)

To keep the system as fail safe as possible it is designed to concentrate maximum intelligence in the field to always provide sufficient information for the operators. This provides the appropriate information even if the communication link to the ATG Mail Computer or the FCC System fails. All measured data (level, temperature, density, water interface level and even volumes) can be obtained by using a small LCD Display built into the cabinet housing. The ATG program at the FCC provides manual entries for all values that can be entered by the FCC operator in the event of a system breakdown.

### Customized SCADA software

A Windows NT™ based software called FuelsManager™ is used to display the data elements and associated graphics. The system provides enhanced access to all tank data combined with the high level of security. It is designed to:

- Monitor product and water levels, and product average temperature and density for fuels of varying viscosity, in tanks of varying size and configuration,
- Use the collected tank data and Customer-supplied tank gauging charts (strapping tables) to calculate the gross product volume in each fuel tank,
- Provide audible and visual alarm annunciation for four abnormal tank level states (high, intermediate high, intermediate low, and low) and for tank level changes that deviate from a specified normal state or rate of change,
- Maintain a log file of significant system events, alarms, and malfunctions.

# 2 General Definitions and Specifications

***This manual is written for all Defense Installations regardless of the specific equipment at the installation.***

***The description of the Application Software is for basic operation purposes only. For more Details please refer to the FuelsManager Manual***

## 2.1 Symbols

Symbols used in this manual are:

| *Symbol* | *Description* |
|---|---|
| **<x>** | Press Button x at the Keyboard |
| **<F2>** | Press Button F2 at the Keyboard |
| **<Enter>** | Press Button Enter at the Keyboard |
| **"input"** | Write the word input and press <Enter> |
| **<Ctrl>+<c>** | Press Button Ctrl and c at the same time |
| **Item** | select Menu Item |

## 2.2 Abbreviations

| *Abbreviation* | *Meaning* |
|---|---|
| **ATG** | Automatic Tank Gauging System |
| **RTU** | Remote Terminal (or Telemetry) Unit |
| **FCC** | Fuel Control Center |
| **LAN** | Local Area Network |
| **WAN** | Wide Area Network |
| **DCP** | Data Collecting Point (local Controller) |
| **LCD** | Liquid Crystal Display |
| **LDU** | Local Display Unit |
| **RAS** | Remote Access Service (Logging into the Network via Modem) |
| **FTP** | File Transfer Protocol |
| **SCADA** | Supervisory Control And Data Acquisition (Program for the FCC operator) |
| **ODBC** | Open Data Base Call |

# 3 System Configuration

The ATG system is designed as a modular hierarchical system containing three main parts:

- Tank measurement devices,
- Data Collecting Point,
- Control computer at the Fuel Control Center (FCC)

All measured tank data are collected by the remote controller RTU at the DCP and transferred to the FCC by direct telephone line or by wireless radio.

The Control computer at the FCC (ATG Main Computer) collects the data, stores them as an ASCII file and indicates data on the screen in various lists. It provides the access by higher leveled data base servers through standardized protocols like ODBC calls.

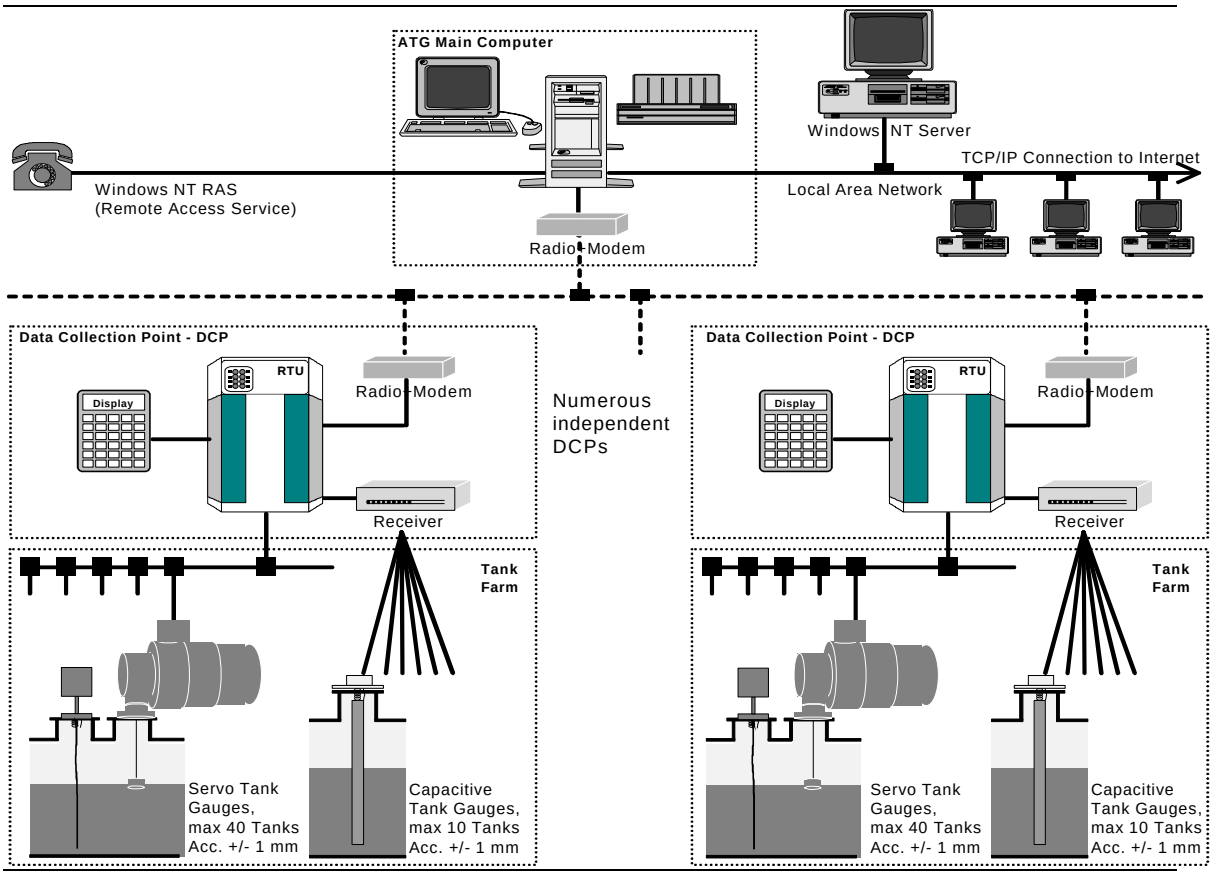


**Figure 1: System Configuration Overview**

## 3.1 Tank Gauges

### 3.1.1 Tank gauging tanks type II

For type II tanks, a Servo Gauge ENRAF type 854 ATG is used to measure product and bottom water levels and average density.

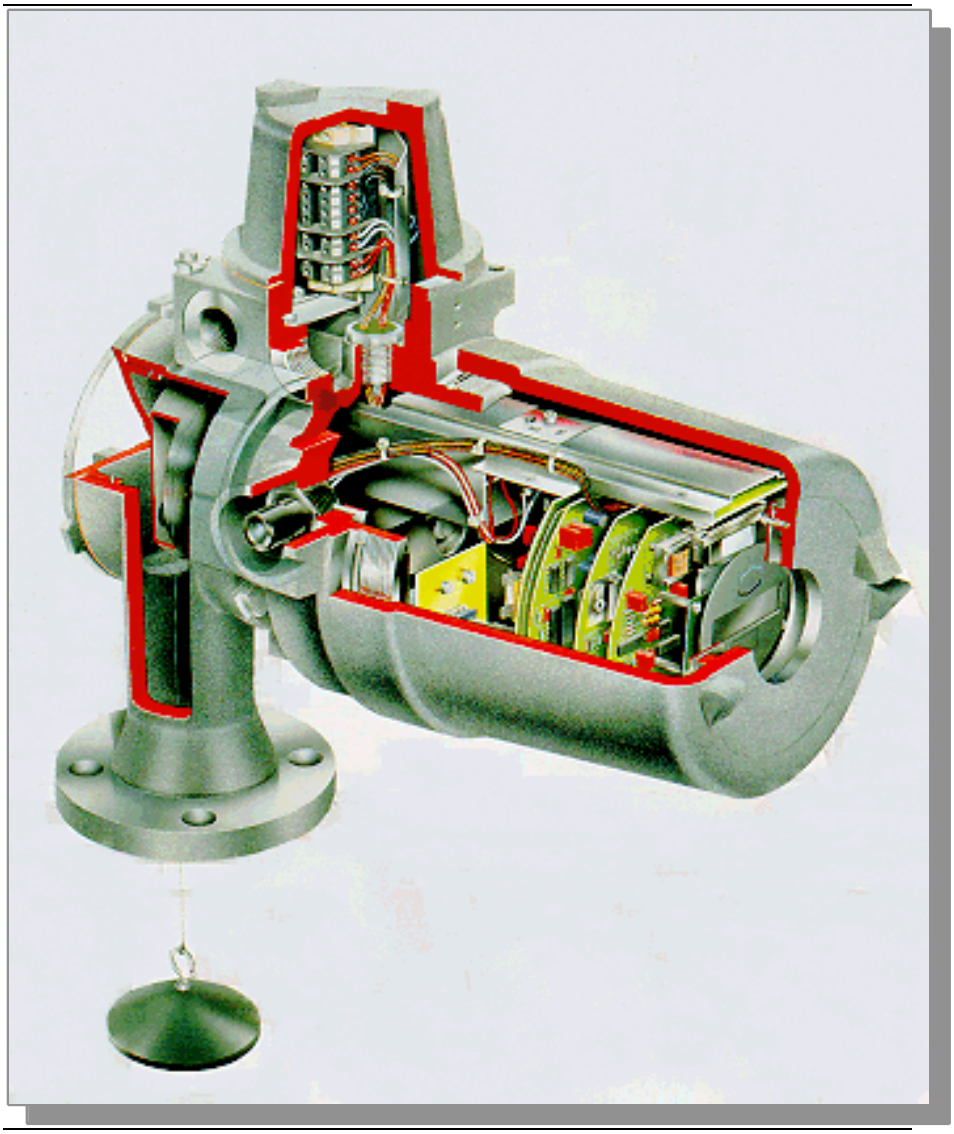

**Figure 2: View of an ATG Servo Gauge**

The principle is based on the detection of variations in the buoyancy of a displacer.

The displacer is suspended from a strong, flexible measuring wire which is stored on a precisely grooved measuring drum. The shaft of the drum is connected to the stepping motor via a magnetic coupling.

Each tank gauge has a built-in local display which can be seen through a glass window (pressure-proof).

The apparent weight of the displacer is measured by a force transducer. The actual output value of the force transducer is compared with a desired value for the apparent weight of the displacer.

If a discrepancy exists between measured and desired value, an advantage software control module adjusts the position of the stepper motor.

## Level measurement

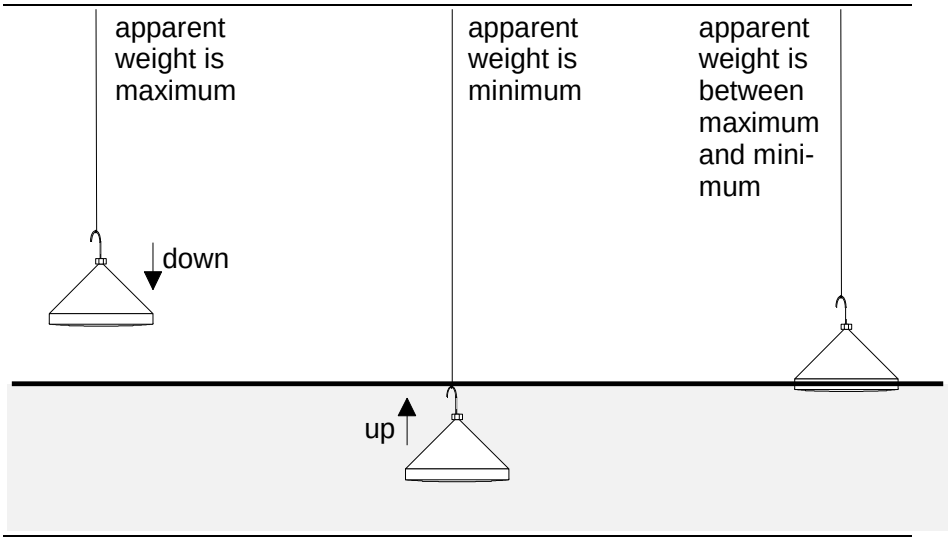


**Figure 3: Principle of the Servo Gauge**

A level variation of product, in which the displacer is partially immersed, causes a change in buoyancy, which will be detected by the force transducer.

The resulting difference between measured and desired value will cause a variation in the position of the stepper motor and consequently raise or lower the position of the displacer until the measured value equals the desired value.

The correct functioning of the stepping motor is continuously checked.

## Relative density and water level

To measure the relative density, the displacer is positioned at a specific height and the apparent weight of the displacer is measured.

Knowing the volume of the displacer, its weight in air, and the measured apparent weight, the relative density of the product at the position of the displacer can be calculated.

The measurement is started by the operator. At the beginning of the density measurement the displacer traverses the product in downward direction until it encounters water (interface level). Then this distance is subdivided into 10 parts and the average density is calculated.

During the measurement the limit contacts and the filling level indicator of the tank gauge are inoperative.

The Water interface level is measured similarly. The displacer lowers, until it detects a change of density, which is usually the indication for the Water Interface Level.

***Note: The indicated level is not necessarily the Water Bottom. It might also be sludge in the tank. It is definitely not fuel.***

### Manual Tank Gauging

Due to local installation conditions, the manual gauging might be performed through the same tank opening as the ATG servo gauge. In this case the displacer can be damaged by the bob on the tape. Precaution should be taken when performing this operation..

***If manual gauging or sampling is performed through an opening of the ATG adapter, the displacer must be raised before opening of the door of the adapter. Perform this function by either pressing the respective Pushbutton at the DCP cabinet or by using the "raise displacer" command at the SCADA computer.***

## 3.1.2 Tank gauging tanks types I

For type I tanks, an ENRAF Series 867/818 STIC system is used to continuously monitor water and fuel level, fuel volume, and average product temperature. The STIC probe is designed for installation on above ground or underground storage tanks. The STIC system is manufactured and commercialized under license from SHELL Research Limited.

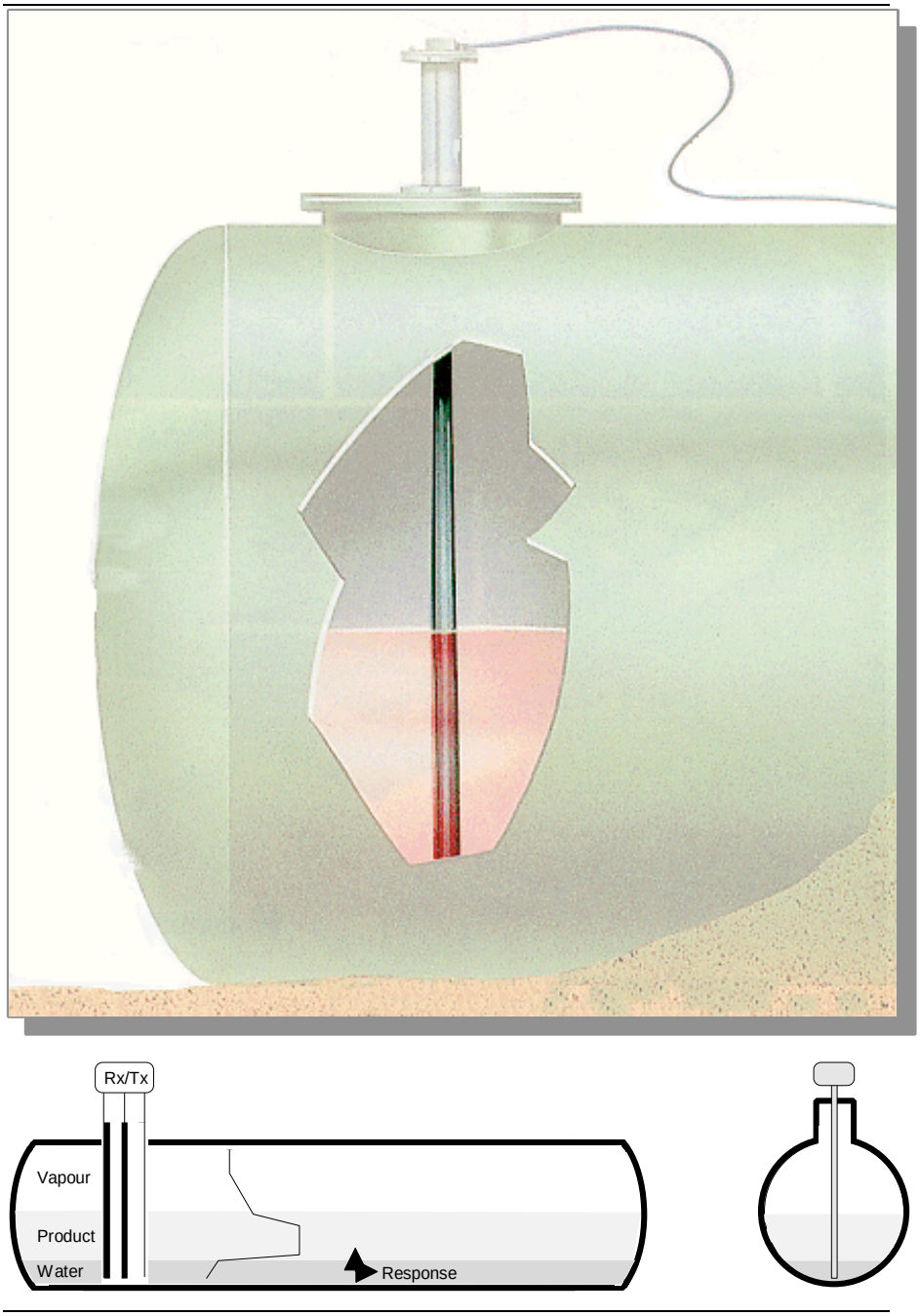


**Figure 4: Principle of the STIC Gauge**

The STIC Probe, designed as a stick with several capacitors, combines a high resolution capacitive level gauge with a high precision average temperature measuring unit. Level measurement is performed by analyzing the response of a large number of 8 mm (1/3") long capacitor elements.

The solid state constructions guarantees unmatched long-term stability and reliability, while the use of small capacitors result the high resolution and outstanding repeatability figures. The product level can be measured by the difference of the electrical constant between vapor and product (see picture). Water-Interface Level measurement is done via the same principle.

Temperature measurement is effected by three temperature sensors distributed over the length of the probe, ensuring a precise average product temperature measurement by selecting the immersed sensor elements.

The STIC receiver type 867 continuously scans the connected probes. It is connected to the host-PLC.

### 3.1.3 Measuring principles

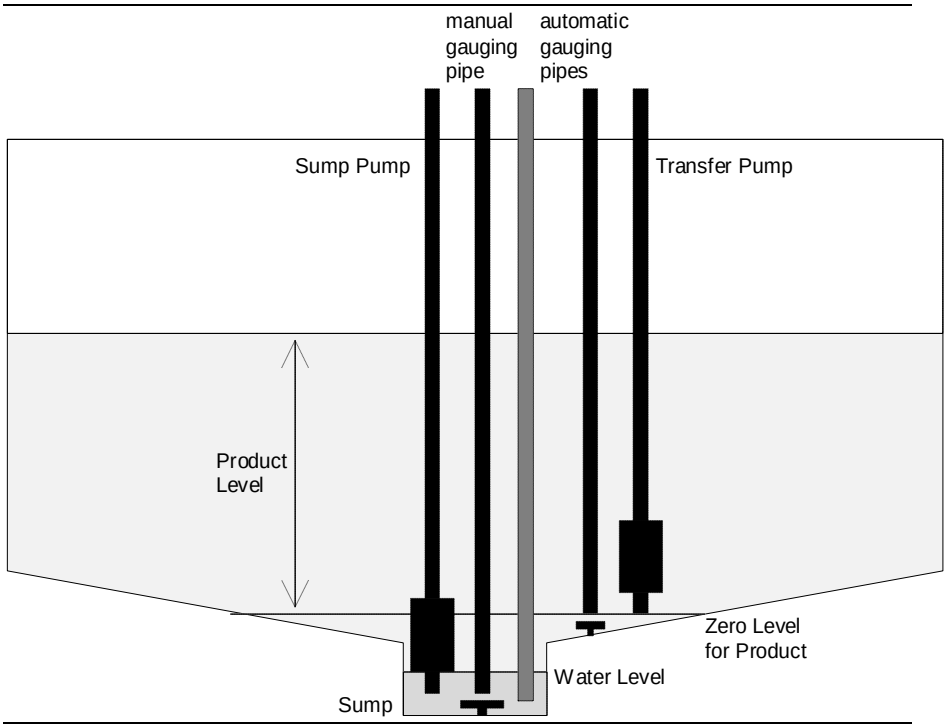


**Figure 5: Side view of a large tank**

Figure 6 indicates the principle of a tank class II (Cut&Cover). Only the principle is indicated, the tanks at the individual installation can be different. The picture is not drawn to scale.

Usually two different pumps (Transfer Pump and Sump Pump) are available for unloading the tank: One pump to unload the product, and one pump to empty the sump (important to empty the water inside the sump) and to empty the tank completely.

During commissioning the product level is gauged manually and this value is used as a calibration point for the automatic tank gauging units; the device is adjusted to indicate the same value as obtained from the manual gauging.

The lower limit switch for the moving range of the displacer is usually set 2-3 mm (1/10”-1/8”) above the bottom of the tank (or the gauging plate if existing). The fuel levels (LowLow Level, Low Level, High Level (=SafeFill), HighHigh Level) are adjusted according to the existing values.

The exact levels can be read in the individual documentation for the specific installation.

***During normal operations the Tank is considered to be filled not higher than the High Alarm Level (=Safe Fill) and to be emptied not lower than the Low Alarm Level. So all calculations for Available and Remaining Volume are based on the Low Level and High Level positions.***

If the tank is built as indicated in Figure 6, it is only possible to measure water levels outside the sump by using the ATG System. In this case the water level measurement in the sump must be done manually.

If the pipe for the automatic tank gauging is installed over the sump (hatched drawing) or in case the tank is flat-bottomed, no manual gauging is necessary.

***Please be informed about the type of tank in service and whether or not it is possible to measure the water level inside the sump by using the ATG System.***

Also, due to local installation conditions it might be possible that the tank level indication stops some inches (sometimes feet) above Zero when emptying the tank completely. This is due to the Lower Motor Limit-switch of the Servo Tank Gauge, which has to be set to make sure, the displacer will not touch any part of the tank bottom or stilling well.

### 3.1.4 Temperature measurement

The temperature measuring unit is basically a solid state electronic element selector containing all hardware necessary for selecting and measuring with up to 16 spot temperature elements.

Since most liquids stored in storage tanks are not homogeneous in temperature an average temperature measurement over the entire liquid column is required.

The product temperature is calculated by taking the average value of the spot elements immersed. To ensure a precise temperature measurement with thermocouple, a PT 100 element is used as a reference temperature measurement.

### 3.1.5 Separate density measurement (Type I tanks only)

The Endress+Hauser SILOMETER is an evaluation instrument for the two probes.

The density is calculated by measuring the difference of the weight of the liquid inside the tank in two different, exactly defined levels. The device consists of 2 hydrostatic pressure sensors whose signals are analyzed by a microprocessor control unit.

The density cannot be taken if both probes are not covered with the fluid (if the level lowers too much). In this case the system defaults to the last measured value which is used as a settled output signal.

***If the tank is emptied below the depth of the short probe, the Density displayed is the last known good value until the tank is again refilled to a level that covers both probes.***

### 3.1.6 Data transfer by radio

If radio frequencies are available (not available for systems in Japan and Korea) Radio sets are installed for the data transfer from the DCP to the control center. The radio system is the same type for all stations.

***Beware of the antenna especially during military exercises. To prevent disruption the antenna must not be covered, e.g. with camouflage nets !***

The antennas are mounted on a large mast installed to the wall of the respective building (DCP or FCC) and connected to the radio set.

Data communication between DCPs and the control center is performed by cyclically polling of the different DCPs by means of the radio set in the control center.

If data changes occurs in a DCP, the response is given as a long message, if nothing changes, the response is a short message.

## 3.2 ATG Main Computer

The ATG main Computer is located at the Fuels Control Center (FCC). It is a specially configured Personal Computer with the SCADA software installed on a Windows NT™ Platform. The Hardware and Network installation is provided by the US Government.

The system collects the tank data from the local DCP (Data Collecting Point) stations, stores them into a large database and displays the data on the screen.

All data displays can be accessed through different graphical Menus.

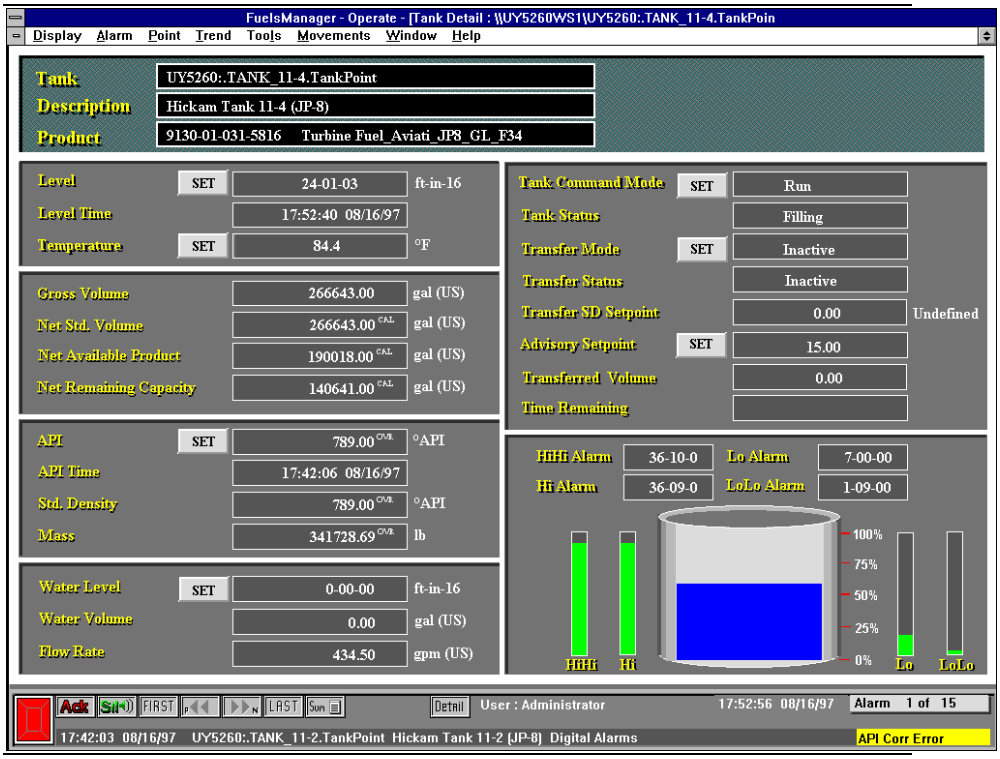


**Figure 6: Tank Detail Example**

The system also displays every active alarm and records them in a log-file that can later be used to analyze the frequency and types of disturbances.

The main task of the system is the communication to and from the higher leveled DOD LAN (Local Area Network). The system contains drivers for communication with UNIX and DOS/Windows computers.

Up to 10 operators (limited by the Windows NT Workstation License) can log into the system as remote stations and run the same protocol as at the system console as well as seeing the same graphics and real-time data as the ATG Main Computer. The remote computers have to be connected via the local Windows Network or via Modem (using the Windows NT RAS function). It is also possible to transfer a file containing actual tank data and to display the data when required..

### 3.2.1 Volume calculation

The volume of the fuel inside the tank is calculated by comparing the measured level to a strapping table with the matching volume. A strapping table comprises a minimum of 2 and typically 3000 increments (usually steps of 1/8 Inch). Each increment includes a level and the corresponding volume in liters. The distances between the level-values must not be equal.

Assuming that a linear connection exists between the two steps, the current tank volume is obtained by linear interpolation.

Analogously, the water volume is calculated by means of the interface level. The fuel volume is obtained by subtracting the water volume from the current tank volume. The displays at the main computer will indicate the Gross Volume (containing the summary of water and product) as well as the Net Volume (indicating the standardized fuel volume at 60ºF minus the actual water volume).

# 4 Local Operation of the system

This chapter describes the operation of the local DCP.

## 4.1 Overview of the DCP Cabinet

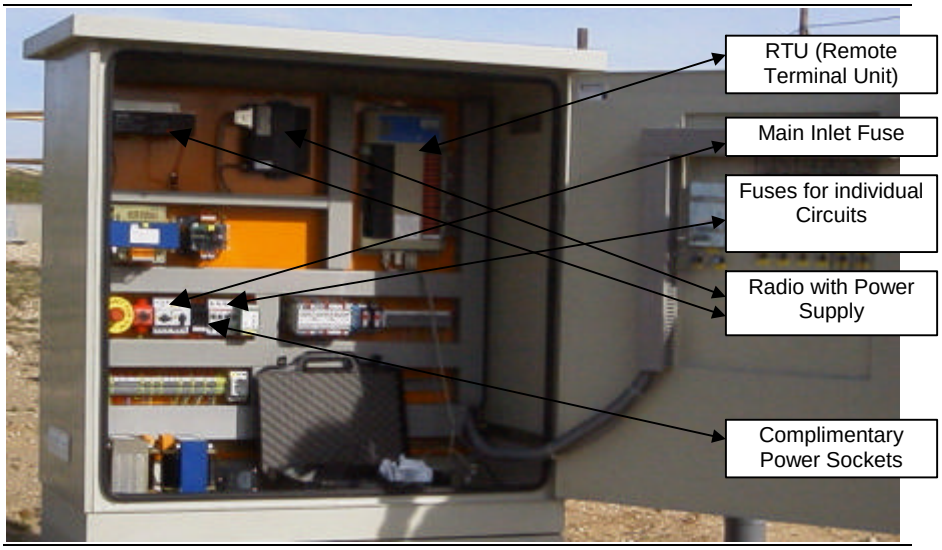


**Figure 7: Inside View of DCP cabinet**

Usually no operation is required inside the DCP Cabinet unless ALSTOM advises during remote support. The overview is for information only. Figure 8 represents a typical DCP that supports Type I tanks, or a combination of Type I and Type II tanks. Figure 9 is a typical design when only Type II tanks are supported.

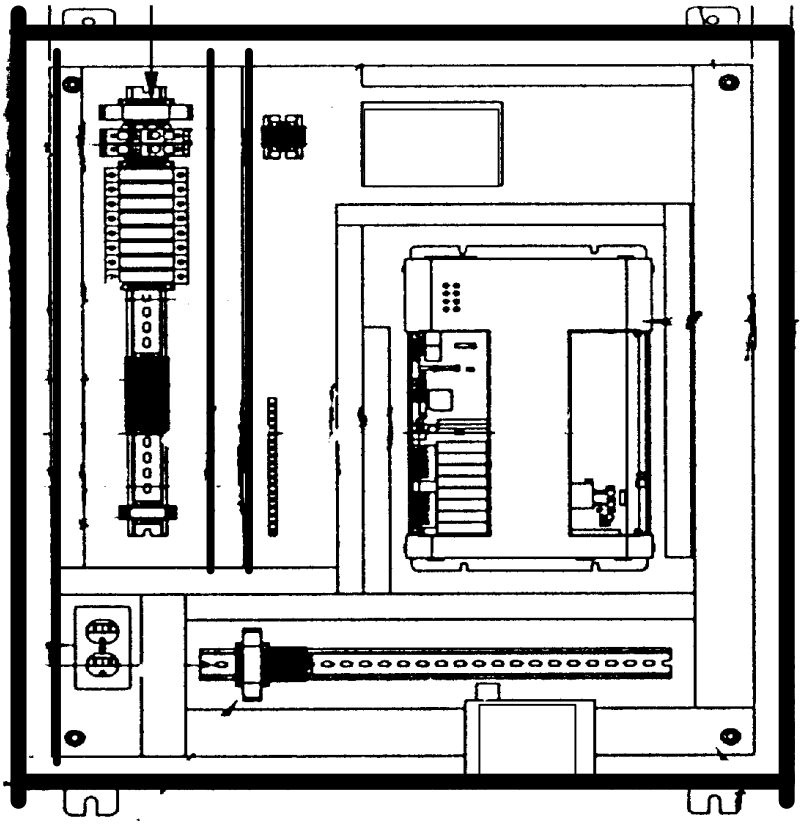

**Figure 9: Type II DCP Cabinet**

## 4.2 Alarm Indication with horn activation in the DCP

Horn activation with lamp test, lamp acknowledgment and horn acknowledgment is realized in each DCP.

Upon arrival of a fault signal the horn is activated. The horn can be acknowledged by use of push-button.

## 4.3 Operation of the local display at the measurement device

If an operator is working on top of the tank equipped with an Servo Gauge (Tank Type II) it is possible to use the local display at the 854ATG tank gauging device to check the actual level and Temperature of the fuel inside. The display is located at the backside of the ATG device.

## 4.4 Manual Measurement of the Fuel Level

Depending on local conditions the existing Gauge Hatch may be used to install the Servo type tank gauge. In this case the opening at the Adapter is used for a manual measurement of the tank level. As the displacer as well as

the weighing unit are extremely sensitive devices, any physical shock could lead into a malfunction of the gauge. For this reason Pushbuttons are located at the DCP which will raise the displacer to a safe top position.

***Please check with local installation condition, if the access to the tank is performed through the same opening as the Servo Gauge. Never drop any devices like Strapping Tape weights, sampling bottles or similar into the opening below a Servo Gauge, without prior lifting of the displacer to the Top Position.***

The displacer can be raised either via the push-button or by using the Command Window at the SCADA system. Whenever a remote command is performed via the ATG Computer the local operators should be informed.

## 4.5 Operation of the LCD terminal at the DCP Cabinet

The LCD terminal provides easy access to all actual tank data at the DCP cabinet. All Data are indicated at the upper 3 lines, line 4 is used for operation commands. 3 keys are used to operate:

- <Shift> and <ESC> buttons pressed consecutively to select the Main Menu
- <1> through <3> buttons to select from the menu
- <Enter> button to get the next reading or, at the Main Menu, to toggle between the selection menus if more than 3 tanks are connected to the DCP.
- <ESC> button to get the previous reading

The indicated values are:

| *Data* | *Units* |
|---|---|
| **Level xx-xx-xx** | [Ft.-Inch-1/16th fraction] |
| **Temperature** | [Degrees Fahrenheit] |
| **Density:** | [Degrees API] |
| **Water-level** | [Ft.-Inch-1/16th fraction] |
| **Volume:** | [US Gallons] |
| **Water Volume:** | [US Gallons] |

The Volume indication is independent from the calculation by the ATG server in the FCC. The LCD value is intended to be used for quick reference only and in case of system failure in the FCC.

***Note: Due to the storage capacity of the Telemetry Unit the Volumes indicated at the LCD might be not as accurate as the volumes indicated at the FCC.***

If other messages are indicated (e.g. "Character Time-out") press the <Enter> button and the Main Menu will be displayed.

# 5 ATG Main Computer

***The ATG Main Computer hardware is a very sensitive device. Please operate the system very carefully, i.e. do not spill any liquids on components of the system. Never move the PC while switched on. The system is also sensitive to impacts or shocks on the PC-hardware***

## 5.1 Basic Operations

### 5.1.1 Switching on and off the system

The system is designed to run 24 h a day. If the system is switched off, the software will be loaded automatically after return of voltage or turning on the power button.

***We strongly recommend the use of an Uninterruptable Power Supply (UPS). The UPS should be line conditioning - permanently charging battery feeding the output. The Power must be sufficient to support both Computer and Monitor (used Watts times 3 for the switching rush) and the battery capable of at least 15 minutes operation.***

Before switching off the computer, the program has to be shut down by a logged in user. If the system is turned off without shut down (i.e. after a main power failure) it checks all files and configurations on the Harddisk.

Please ensure no diskette is inserted to the floppy disk drive before booting the system. During regular operation the "Power on" LED is illuminated, the "Access HD" LED sometimes may blink.

The starting of the SCADA program is only possible, if a Hardware-key (so called "Dongle") is connected to the printer port. No operation is possible without this key. Printers may be connected to this key.

### 5.1.2 Starting of the ATG Program

The Software is divided into three major parts:

- Fuelsmngr This background program provides the communication link to the DCPs and is responsible for updating the Database. Usually it is set up as a Service which is started automatically after booting the system.

- FMOperate This program, started by clicking on the respective icon, is for operating the ATG system through the ATG main Computer. The program provides all Graphics, and data necessary for the User.

- FMUser This program, to be used by the Administrator or the System Engineer only, provides a shell to access all configuration tools for changing graphics, creating reports and modifying the data model.

### 5.1.3 User Levels

The Users/Operators are predefined by the Windows NT Operation System. Additionally, all Users have to be entered into the SCADA Software to be able to operate the system.

### 5.1.4 Software Operation

The system, as all Windows™ Systems, is designed to be operated by Mouse-Click. However to accelerate the operation Function-keys are predefined.

| *Function Key* | *Description* |
|---|---|
| **F 1** | Open Index Display (Main Menu) |
| **F 2** | Open Graphics (select from list) |
| **F 3** | Open Report (select from list) |
| **F 4** | Point open / restore (Administrator only) |
| **F 5** | Alarm Summary |
| **F 6** | Alarm Silence |
| **F 7** | Open Tank Detail |
| **F 8** | Open Tank Group (not used) |
| **F 12** | Help Index |

***These Function Keys are valid for the Operator shell only. Other programs have different definitions for the Function Keys***

### 5.1.5 Remote Log In from the Network

The ATG server can be accessed through local LAN (as well as through analog or digital routers). Every operator, no matter if local or remote,

requires an NT user account and the FuelsManager user account on both machines, the remote one and the ATG server. If the Password for remote and ATG machine are identical, the software can be started instantly and provides all data. If the password is different:

- Log into Remote machine with the ATG user account.
- Go to "Network Environment" and find the ATG machine.
- Double click on the ATG machine and open a public directory. The system will ask you for a user account and password. You can either take a generic account (e.g. POL) or your own account with the valid password on the ATG machine.
- As soon as the Directory contents show up log in is complete. Do NOT close this window, until you are done with the operation of the ATG.
- Ensure that the FMService is started or start the "Fuelsmngr.exe" program. Start FMoperate. If no log in was performed a error message "Disconnected" is indicated.

If frequent operation is required we recommend on putting the same password on both machines. Using a Windows NT Domain will handle all the password organization.

## 5.2 Basic Software Description

### 5.2.1 Describing the fmOPERATE Window

The fmOPERATE window appears when the operator starts up or logs onto the fmOPERATE program. The graphic displayed depends on the facility’s specifications.

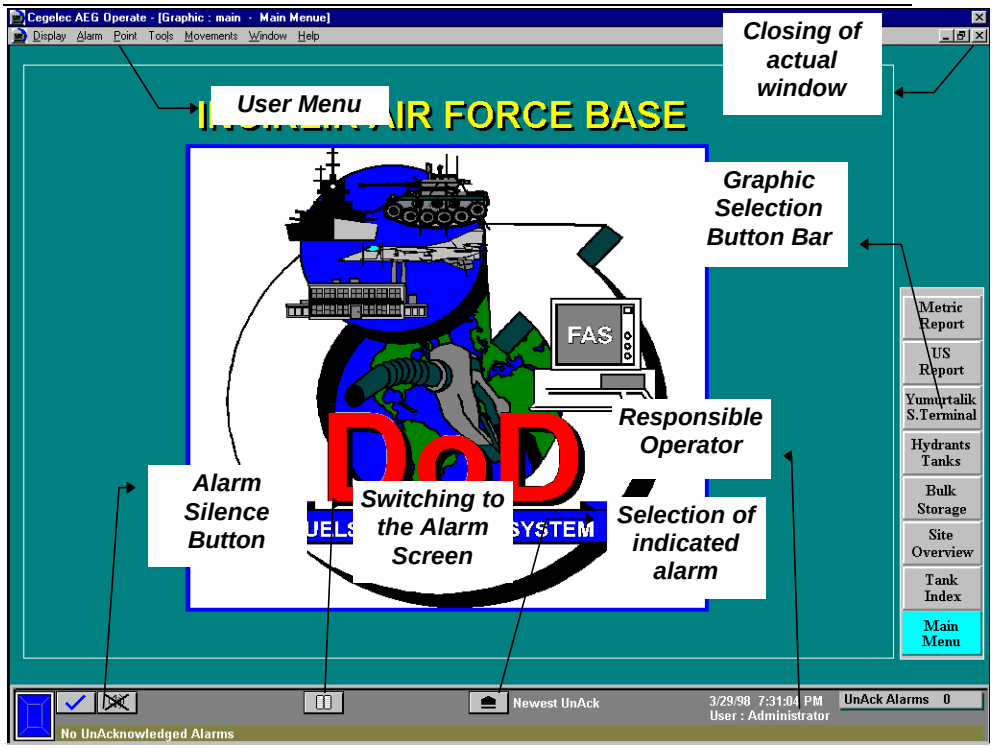


**Figure 10: Explanation of the menu system**

### Title Bar

The title bar displays the FuelsManager Operate name, the type of window and the file name. There are four windows available in the fmOPERATE program -the Graphic, Report, Tank Detail, and Tank Group windows. These windows are accessed from the Open... cascading menu in the Display menu.

### Menu Bar

From the menu bar, the operator is able to perform the functions necessary to operate the program. Depending on the type of active window, the menus as well as some menu options may change. For example, the Report window contains two extra menus, Print and Page, used specifically for reports. There are four menus that remain constant in each type of window: the Display, Alarm, Point, and Trend menus. The Window menu is found in every window type, but its menu options change for each window type. For example, the Select...option has a different function in the Tank Detail window as opposed to the Graphic window.

| *Menu Title* | *Description and Content* |
|---|---|
| **Display menu** | The Display menu enables the operator to open different fmOPERATE windows, view FuelsManager system communications, and to exit the fmOPERATE program. |

| | |
|---|---|
| | • The Index Display option opens the main graphic of the program.<br>• The Open option opens any type of fmOPERATE window such as: the Graphic, Report, Tank Detail, or Tank Group window.<br>• The Communications option allows the user to view the diagnostic information of the system.<br>• The Exit Operate option closes the fmOPERATE program. |
| **Alarm menu** | The Alarm menu enables the operator to acknowledge, silence, and view alarms. These options can also be performed from the Alarm Toolbar found at the bottom of the fmOPERATE window.<br>• The operator can silence an audible alarm by selecting the Silence option.<br>• The Alarm Line option allows the user to acknowledge as well as maneuver through alarms.<br>• The Summary option displays a cascading menu containing the Open/Restore and Close Window menu options.<br>• Open/Restore opens the Alarm Summary. This summary lists all active alarms and their corresponding locations and statuses.<br>• Close Window closes the window.<br>• Selecting the Show Log File Browser option displays the alarm and event logs for any selected day. |
| **Point menu** | The Point menu allows the user to create a Point display used to monitor a database value and to manually change that point if allowed. This menu also contains management functions used to control the Point display.<br>• The Define menu option is used to select a point from the database to monitor or control.<br>• The Open/Restore menu option opens a defined point or restores the display from its icon.<br>• The Close Window closes the Point display. The Minimize option reduces the display to an icon. |
| **Tools menu** | The enables the operator to record keystrokes and mouse selections only on fmOPERATE graphics. You can run the macro and the system automatically performs the graphics-related commands and prompts you with the resulting dialogs. |
| **Trend menu** | The Trend menu allows the user to create a Trend display used to monitor the real-time trend analysis of a database point. This menu also contains management functions used to control the Trend display.<br>• The Define Real Time Trend menu option is used to select a point from the database.<br>• The Load menu option opens a saved Trend eliminating the user from having to recreate the Trend.<br>• The Open/Restore menu option opens a saved trend.<br>• The Close Window closes the trend. |
| **Window menu** | The Window menu allows the user to perform standard window functions such as tiling, cascading, arranging icons, and closing all opened fmOPERATE windows. Depending on the type of |

window that is active, the contents of this menu change.

### 5.2.2 Alarm Toolbar

The Alarm Toolbar is found at the bottom of every window. In addition to using the Alarm menu, the operator can acknowledge and view alarms by clicking on the displayed pushbuttons. The Alarm Toolbar also displays information such as the number of alarms, the alarm description, and alarm priority. The Alarm Toolbar displays only one alarm at a time. The operator is able to scroll through the other alarms by clicking on the "<<" and ">>" pushbuttons.

#### Current Alarm #

Alarms appear in the order in which they occur. This number indicates when the alarm occurred in relation to any other alarm (e.g. 1 of 4).

#### Alarm Line

The Alarm Line describes an alarm in the system. If no alarms are present, the Alarm Line will display " **NO ACTIVE ALARMS** ". When an alarm is present, the line displays the following information.

| *Indication* | *Description* |
|---|---|
| **Time** | The time of day when the alarm occurred. The time is expressed in the form: HH:MM:SS (Hour, minute, second). Date: The date the alarm occurred. The date is expressed in the form: MM/DD/YY (Month, Day, Year). |
| **Database Point** | The name as it appears in the database (Tank_34.Gauge) and the corresponding variable (Level). |
| **Alarm Status** | The database point's alarm condition. Examples include Disconnected, High-High, and Movement Alarm. |

#### Current Alarm Status

The current alarm depends on the database value. For example, if a tank level alarm becomes active, this line would display a status such as "Low" or High-High".

***The Current Alarm Status, Alarm Indicator Box, and Alarm Summary will have similar color-coding.***

| *Alarm Status Condition* | *Description* |
|---|---|
| **Flashing color** | Unacknowledged Active alarm. |
| **Flashing green** | Alarm has returned to normal but has not been acknowledged. |
| **Non-flashing color** | Alarm has NOT returned to normal, but has been acknowledged. |

### Alarm Indicator Box

The Alarm Indicator Box will display the color of the highest priority active alarm in the system. For example, suppose red has a higher priority over yellow. An alarm with a High alarm status will flash yellow, and an alarm with a High-High alarm status will flash red. If two alarms containing these two alarm statuses become active, the Alarm Indicator Box will flash red. If the highest priority alarm in the system is of the High alarm status, the Alarm Indicator Box will flash yellow.

### Pushbutton Alarm Icons

The operator can browse through any current alarms using the pushbutton icons.

| *Alarm Pushbutton* | *Description* |
|---|---|
|  | Used to acknowledge an alarm. |
|  | Used to silence an audible alarm. |
|  | Used to view the first alarm in the current fmOPERATE session. |
|  | Used to view the alarm previous to the alarm currently displayed. |
|  | Used to view the next alarm after the alarm currently displayed. |
|  | Used to view the last alarm in the current fmOPERATE |

| | |
|---|---|
| | session. |
|  | Used to view the Alarm Summary. |
|  | Used to select a Tank Detail screen related to the indicated alarm (e.g. Level Alarm). Only if available. |
|  | Used to select the Alarm Line indication:<br>• Newest Unacknowledged Alarm<br>• Oldest Unacknowledged Alarm<br>• Newest Alarm<br>• Oldest Alarm<br>• Select desired Alarm indication |

An additional three pushbuttons are available depending on the type of an alarm. Some alarms will contain an associated graphic and/or help file.

**Other Pushbuttons Description**

| | |
|---|---|
| Graphic | Visible if there is a graphic assigned to the currently displayed alarm. It is used to activate the run-time graphic associated with that alarm. |
| Help | Visible if there is a help file associated with the currently displayed alarm. |
| Detail | Visible only if the alarm pertains to a tank. It is used to activate the Tank Detail associated with the alarm. |

### 5.2.3 Window

There are four types of windows found in fmOPERATE. These windows are used to display Real-time Reports, Tank Details, Tank Group Displays, and Interactive Graphics. Two of these windows, the Tank Detail and Tank Group windows, have been designed specifically for tank data monitoring and control.

| *Window Type* | *Description* | *Enables the Operator To…* |
|---|---|---|
| **Graphic Window** | Displays facility-specific graphics | · Access other graphics through available pushbuttons<br>· Monitor and view components of the facility |
| **Report Window** | Displays facility-specific and standard reports | · View real-time spreadsheet reports<br>· Print a report |
| **Tank Detail Window** | Displays Tank Details. A separate Tank Detail is available for each tank report. | · Perform tank transfers<br>· Perform calculations<br>· Modify tank data |
| **Tank Group Window** | Displays Tank Group Displays. A Tank Group Display is an operator-configurable spreadsheet. | · View real-time tank point data in an operator-configurable spreadsheet<br>· Access Tank Detail for a selected row |

### To open a window

Select Display and click on Open. Select the desired window.

### To close a window

Click on the upper right button located at the top of the screen (  ). To iconize use  , to maximize  , to get movable screens use  .

***Note: The Operate program can neither be iconized nor size reduced.***

***For further details please refer the Windows NT manual.***

## 5.3 Describing the fmOPERATE Menus

***Most of these menu items are intended for Administrators only. They may be locked for other Operators. Please be careful while using these functions and modify values only if advised by an ALSTOM Systems and Automation employee.***

### 5.3.1 Display Menu

The Display menu enables the operator to display different Fuels Manager windows, view Fuels Manager system communications, and to exit the fmOPERATE program. The menu options are described below.

#### Index Display

The Index Display is the first graphic that appears on the screen when fmOPERATE is opened. The graphic featured in the previous Describing the fmOPERATE Window section is the Fuels Manager Logo Index Display. Your Index Display will be a facility-specific graphic.

#### To view the Index Display

Select Display and click on Index Display, or press F1.

#### Open

There are four types of windows that can be displayed and up to sixteen (16) windows may be open at once.

#### Communications

The Communications option from the Display menu is used to view the FuelsManager system communications status. This option is useful for diagnostic purposes.

- To display the Communications dialog box click on the option. From this diagnostic display the user can reset all the counters to “0”.

#### Exit Operate

This menu option allows the operator to exit the fmOPERATE program. A message will appear requesting verification before exiting.

### 5.3.2 Alarm Menu

This menu enables the operator to silence, acknowledge and browse through alarms. The operator is also able to access the Alarm Summary.

### Silence

Select this option to silence the alarm(s), or press F6.

### Alarm Line

You will notice that the Alarm Line cascading menu includes the same capabilities found in the Alarm Toolbar (found at the bottom of the window). Selecting any of these options produces the same result as pressing the corresponding icon pushbutton in the Alarm Toolbar.

### Summary

The Summary menu is used to open, restore, and close the Alarm Summary. The Alarm Summary lists the current alarms with the most recent alarm displayed at the top of the list. The options found in the Alarm Summary cascading menus are described below.

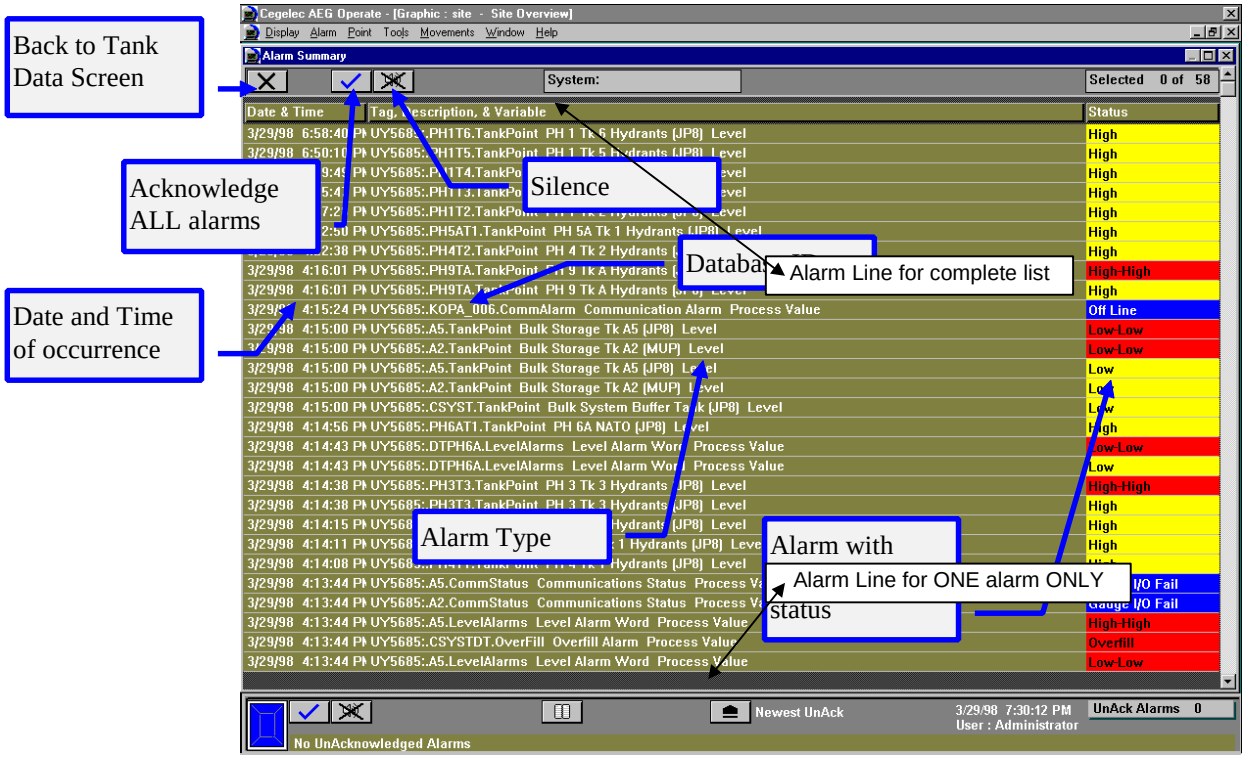


**Figure 8: Example for an alarm screen**

- Open/Restore: Select this option to open the Alarm Summary, or press F5. Once opened, the operator is able to change the length of the Alarm Summary by clicking and dragging the bottom edge to a desired position. Selecting this option again will restore the Alarm Summary to its full size.

- Close Window: This option closes the Alarm Summary.

Coded Alarm Colors

| *Window Type* | *Enables the Operator To…* |
|---|---|
| **Yellow blinking** | Warning, e.g. High or Low level. Information not yet acknowledged |
| **Yellow, steady light** | Same, but already acknowledged |
| **Red blinking** | Alarm, e.g. HighHigh or LowLow level. Information not yet acknowledged |
| **Red, steady light** | Same, but already acknowledged |
| **Blue** | System or Device failure |
| **Green blinking** | Alarm already gone but not yet acknowledged |

#### Show Log File Browser

This menu option displays the Log File Browser. The Log File Browser lists all the alarms and events for a selected day. Whenever an alarm or event occurs, it is logged to this disk file. The operator is able to view and print all events, alarms, or both of any selected day. The operator can view a day file by selecting the appropriate system, date, and viewing selection (alarms, events, or both). The operator then selects Open... to open the file. If this entry does not exist, a message will appear. If the operator wants to print the daily log, click on Print. Refer to your Microsoft Windows NT manual for further information about the print dialogs.

***Note: the operator is also able to connect to a printer from Windows NT Print Manager. See your Microsoft Windows NT manual for instruction.***

### 5.3.3 Point Menu (Administrator Only)

***Note: Any Modification in this section may seriously affect the function of the system. Please be careful with changes.***

The Point menu enables the operator to continuously monitor any point and variable in the FuelsManager database. This important feature enables the operator to either monitor a critical value or have it readily available to issue a command.

#### Define

Before you can open the Point Monitor, you must first define the particular point you want to monitor:

- To define a Point:

Select Point and click on Define… If a database has not been selected, the Select Database System dialog box appears. Select the appropriate database

system and click on Select. Otherwise, the Database Edit dialog box appears. This dialog box displays all the points configured for the selected database system.

The operator is able to browse through these levels by using the << Prev Level and Next Level >> pushbuttons. The Select pushbutton will not be enabled until the last level is selected.

Click on Select to display the Select Database Point dialog box. This dialog box displays the choices that were made for the Value-the database, the database point, and the point variable. Confirm that the correct point and corresponding variable are displayed in the dialog box. If not, click on either the Point... or Variable... pushbuttons to edit. Click OK. The Database Point Monitor display appears. In some cases the point can be modified. If a point can be modified, a "Mod" button will appear in the upper right-hand corner of the display. This button enables the operator to issue a command or modify the point's value.

#### Close Window

This option closes the Point Monitor. The Monitor can be reopened without redefining the point.

#### Minimize

This option minimizes the Point Monitor to an icon.

#### Trend Menu

The Trend menu enables the operator to define, save, load, open, and close a Trend. A Trend is a collection of one or more trends with each displaying point variable data in a time-versus-magnitude format. This format simulates the operation of a conventional strip chart recorder. One or more Trends can be defined.

To view a Trend, the operator "loads" a saved Trend into the system. Once the Trend is loaded, it can be opened anytime during the current operator session. Only one trend may be loaded and opened at a time. Please refer the FuelsManager Administrators Handbook for further information.

## 5.4 Using fmOPERATE

### 5.4.1 Viewing a Graphic

Graphics are viewed in the Graphic window. When the operator starts the fmOPERATE program, the graphic window appears. This window may enable the operator to:

- View facility-specific graphics (e.g., overview graphic, tank farm graphic)
- Maneuver between facility-specific graphics.
- Access one or more Tank Details.

- Open multiple graphics.
- Return to the Main graphic.

***NOTE: The capabilities of each graphic depend on your facility's specifications. Select Display and click on Graphic... from the Open cascading menu (or press F2). The Graphic Display Selection dialog box appears. Click on desired display and click OK. The Graphic window appears with your selected graphic.***

### Selecting a New Graphic

- Select Window and click on Select... The Graphic Display Selection dialog box appears. Select the desired graphic and click on OK.

### Restoring a Graphic

This option presents a list of displays that have been activated during the current fmOPERATE session.

- Select Window and click on Stack... The Process Display Stack dialog box appears. The most recently displayed graphic appears at the top of the list.
- Select the desired graphic and click on OK.

### Returning to the Main Graphic

Select Display and click on Index Display (or press F1).

## 5.4.2 Viewing a Report

Reports are viewed in the Report window. The reports discussed in this section are reports that were created in the fmREPORT program. This window enables the operator to:

- Print a report from the Report Manager dialog.
- Display a report.
- Print a report from the Print menu.
- Enable and disable reports.

Select Display and click on Report... from the Open cascading menu (or press F3). The Report Manager dialog box appears. This dialog lists all the reports configured for the fmOPERATE program. The operator can also select a printer from the Printer scroll list as seen in the above figure. The active reports are printed at preset intervals and print times. Contact your Area supervisor for a list of scheduled print times and intervals. From this dialog the operator is able to perform the following actions:

- Enable or disable a report
- Print a report on-demand

- Display the report

***NOTE: To edit print times, refer to the Using the fmREPORT Program chapter.***

### Displaying a Report

Highlight by clicking on the desired report in the Report Manager dialog. Click on Display. The selected report is displayed. Note that the Report Window contains two additional menus-Page and Print.

The Page menu contains the Page Up and Page Down options. Select and click on these options to move up and down the report page.

### To enable a report:

1. Highlight by clicking on the desired report in the Report Manager dialog.

2. Click on Enable. The associated status will read "Active". The previously inactive report will now print at its scheduled time.

### To disable a report

1. Highlight by clicking on the desired report in the Report Manager dialog.

2. Click on Disable. The associated status will read "Inactive". The previously active report will not print at its scheduled time.

### Printing a Report

- To print an undisplayed report

1. Highlight by clicking on the desired report in the Report Manager dialog. Confirm that the correct printer is selected.

2. Click on Print.

- Printing the displayed report

1. Select the Print menu. The following dialog box appears. From this dialog box the operator is able to define the page range, the number of copies, and the desired printer. The operator also has the option of printing to a disk file.

2. Select OK.

- To print a report to a file

The Print to File option allows the operator to store the report as a disk file in the project directory as opposed to printing a hard-copy report. If this option is enabled in the Print dialog and OK is selected, the following dialog will appear.

The disk files will carry the *.prn file extension. These files, which may be viewed using any text file application, should be stored in your project directory. The designated sub-directories where your files will be stored depend on the facility.

### 5.4.3 Viewing a Tank Detail

Every Tank point has a corresponding Tank Detail. Tank Details are viewed in the Tank Detail window.

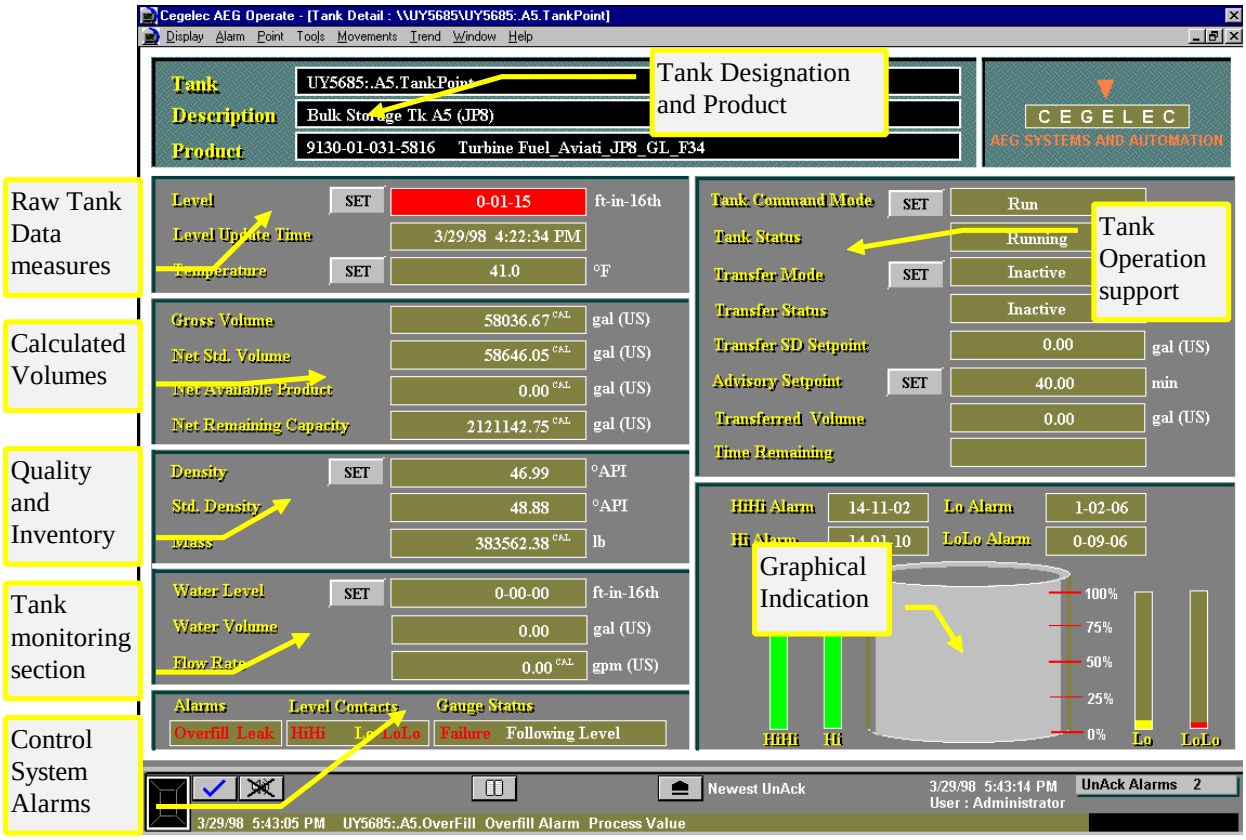


**Figure 12: Tank Detail Screen**

This window enables the operator to:

- View the process data of any tank point such as temperature, level, and volume.
- Perform a tank transfer.
- Modify some tank parameters (if set to Manual).
- Perform tank calculations.
- View multiple Tank Details.

This section describes how to open a Tank Detail and also describes the features of the Tank Detail.

**To open a Tank Detail:**

1. Select Display and click on Tank Detail... from the Open cascading menu (or press F7). The Select Tank Point dialog box will appear. This dialog box displays the tank points available in the selected database. Every tank point has a Tank Detail.

2. Click on a Tank point and choose Select. The Tank Detail for the selected point appears.

### 5.4.4 Description of Tank Detail Items

| *Data Item* | *Description* |
|---|---|
| **Level** | Current level of the tank. |
| **Level Time** | Last time that the tank level was updated. |
| **Temperature** | Current temperature of the tank. |
| **Gross Volume** | Total measured volume of the product in the tank without any correction factors. This is calculated from the tank gauge reading and the tank strapping table. |
| **Net Std. Volume** | Corrected volume of the product in the tank. This is calculated by subtracting the BS&W (Bottom, Sediment and Water) volume from the gross volume and multiplying the difference by the volume correction factor. It takes into account the temperature, the API, and the BS&W. |
| **Net Available Product** | Volume of product that can safely be issued from the tank. This is calculated by subtracting the strapped volume at the LoLo alarm limit from the current strapped volume and multiplying the result by the volume correction factor. |
| **Net Remaining Capacity** | Volume of product that can be added to the tank. This is calculated by subtracting the current strapped volume from the strapped volume at the HiHi alarm limit and multiplying the result by the volume correction factor. |
| **API** | American Petroleum Institute table entry based on the density of a product that is used along with temperature to calculate the volume correction factor. |
| **API Time** | Last time that the API value was updated. |
| **Std. Density** | Density of the product at standard temperature. |
| **Water Level** | Height of water column in the tank. |

| *Data Item* | *Description* |
|---|---|
| **Water Volume** | Strapped volume at the water level. |
| **Mass** | Product mass based on density. |
| **Flow Rate** | Rate of movement based on consecutive level readings. Calculated from the change in volume and the time interval between scans of the tank level based upon a quantitative amount per time frame. |
| **Tank Mode** | Desired direction of product flow into or out of a tank. |
| **Tank Status** | Actual direction of product flow into or out of a tank |
| **Transfer Mode** | How the transfer is measured; by level, by volume, or by differential volume. |
| **Transfer Status** | Current status of a transfer; displays In Progress, Advisory, or Complete. If there is no active transfer for the tank, the status is Inactive. |
| **Transfer SD Setpoint** | The new tank level, volume, or differential volume. |
| **Advisory Setpoint** | Point at which a transfer alarm should be triggered. Can be from 0-120 minutes before the transfer is complete. |
| **Transferred Volume** | Amount of volume transferred into or out of a tank during the last tank transfer. |
| **Time Remaining** | Time left to complete a transfer. |
| **HiHi Alarm** | Limit for a high-high level alarm. If the tank level exceeds the HiHi Alarm, then an alarm will ensue. |
| **Hi Alarm** | Limit for a high level alarm. If the tank level exceeds the Hi Alarm, then an alarm will ensue. |
| **Lo Alarm** | Limit for a low level alarm. If the tank level drops below the Lo Alarm, then an alarm will ensue. |
| **LoLo Alarm** | Limit for a low-low level alarm. If the tank level drops below the LoLo Alarm, then an alarm will ensue. |

### 5.4.5 Performing a Tank Transfer

Each tank includes provisions for advisory and shutdown transfer setpoints. During Tank Transfers, the database calculates the volume transferred and time remaining to transfer completion.

- The operator is notified when the advisory setpoint is reached.

- An operator alarm occurs when the shutdown setpoint is reached, indicating the end of the transfer. Configuration allows transmission of a shutdown command when the shutdown setpoint is reached.

### To perform a tank transfer

1. click on the Transfer Mode pushbutton. The following picture appears:

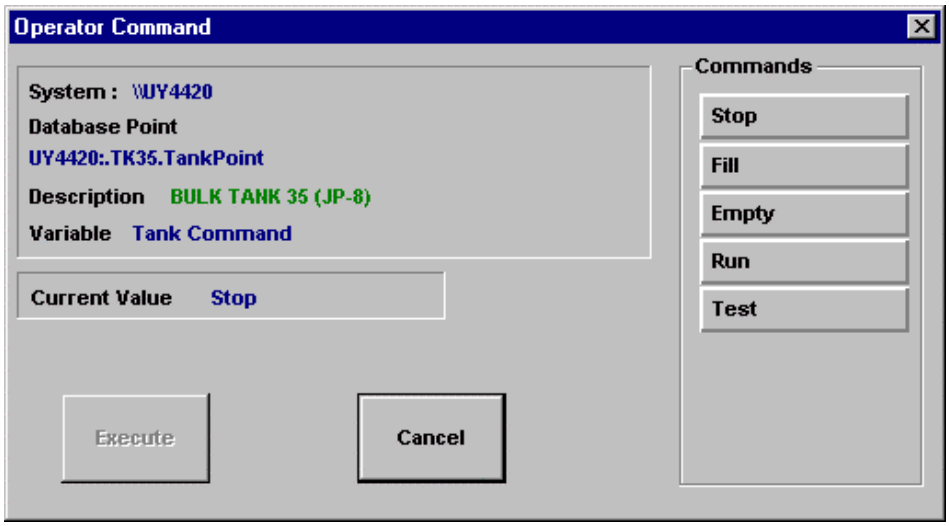


**Figure 13: Command field for Tank Mode Commands**

In this dialog box the operator can transfer by either volume, differential volume, or level. When the transfer process is complete, the Inactive mode pushbutton is selected. These commands are described below.

| *Transfer Mode* | *Description* |
|---|---|
| **Inactive:** | Terminates a transfer. |
| **Volume:** | A transfer that is terminated by Stop Total Volume. |
| **Level:** | A transfer that is terminated by Stop Level. |
| **Diff Volume:** | A transfer that is terminated by the Stop Differential Volume. |

2. Click on the appropriate Pushbutton. Click on Execute. NOTE: This action affects the displayed units found in the Advisory and Shutdown Setpoints.

3. Select or type in the new tank level, volume, or differential volume. Click on Execute.

4. Click on the Advisory Pushbutton.

5. Select or type in the time. This time is used to set when the Transfer Advisory alarm will occur.

6. Click on the Mode Pushbutton (located at the top right section of the window).

The commands are described in the table below. All non allowed movements will cause an Alarm (either Movement Alarm or Flow Direction Alarm). The Alarm occurs only one time. It will come again after changing the Tank Mode.

| *Tank Mode* | *Description* |
|---|---|
| **Stop** | Stops tank. No movement allowed. |
| **Fill** | Fills tank. Upward movement only. |
| **Empty** | Empties tank. Downward movement only. |
| **Run** | Tank could be Filling / Emptying / Stopped. Mode alarms are disabled. |
| **Test** | Mode and Operational alarms disabled. Level alarms not affected. |

7. Select the appropriate command and then click on Execute. This action begins the transfer process.

8. Once the transfer process is complete, click on the Transfer Mode pushbutton. Select Inactive and click on Execute.

### 5.4.6 Modifying Tank Parameters

Modifiable tank parameters contain a SET push-button.

***NOTE: The SET pushbuttons involved in performing a tank transfer are different from the SET pushbuttons mentioned in this discussion.***

When modifying a tank parameter, the operator has the option of forcing the input data to the entered value. Calculated data may be derived from inputs which are forced. The following Manual Override section explains this feature. Tank parameters such as Level, Temperature, Product Code, and Water Level can be modified two different ways:

- Clicking on the associated Set pushbutton in the Tank Detail.
- Using the Point Monitor display (selecting Point and clicking on Define...).

Refer to the Monitoring a Database Value section for more information on using the Point Monitor Display.

**To change a value:**

1. Click on the appropriate Set pushbutton to enter a new value. The following example Operator Command dialog box appears:

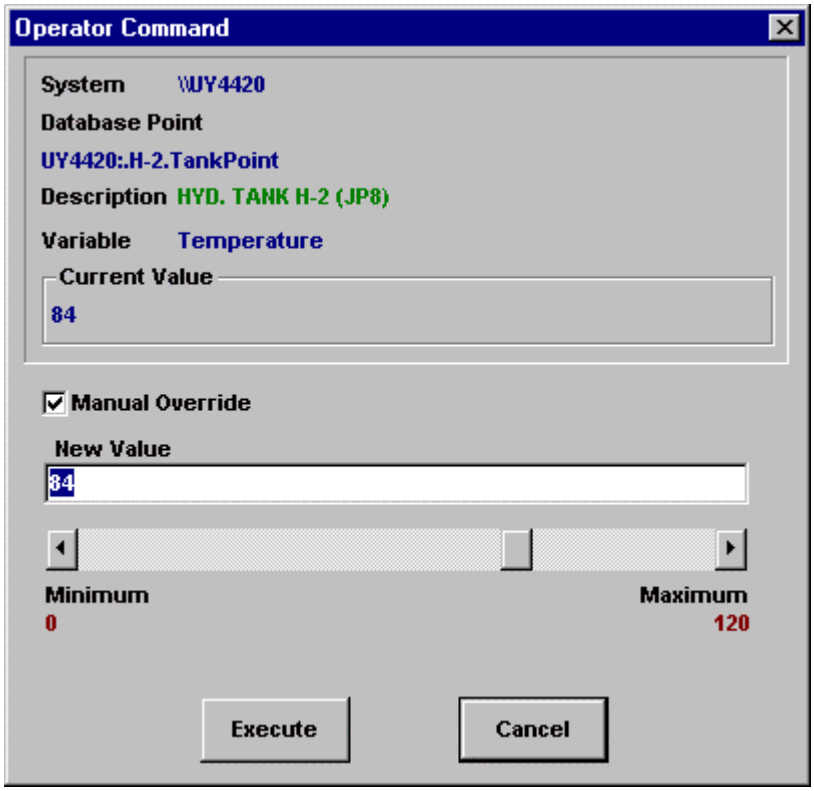


**Figure 14: Forcing Tank Values**

This example dialog box lists the attributes of the variable such as database system, the database point, and tank description. The operator can change current values by typing a value in the text box or by sliding the scroll bar. The operator can force the value by clicking on the Manual Override check box, as illustrated in the above figure. Refer to the following section for a description of the capability.

2. Click on the EXECUTE pushbutton to change the value. Once EXECUTE is selected, the new value is transmitted to the Fuels Manager system.

### To Override a Value:

If the Manual Override feature is enabled for a value, the operator will be able to manually override a database value. These values will be denoted by FRC anywhere the database value appears. Other values may be affected by these forced values. These values also contain superscripts indicating the consequence of the forced value. The superscripts are listed and described below.

| *Data Superscript* | *Description* |
|---|---|
| **FRC** | Input data has been Forced to the current value. |
| **OVR** | Input data exceeds max. value (OVERRANGE) |
| **UND** | Input data falls below min. value (UNDERRANGE) |
| **CAL** | Calculated data has been derived from inputs which are Forced |

To force a value, the operator must select the Manual Override check box when modifying a tank parameter.

***Note: if actual data are missing on the detail screen (e.g. if the communication fails) the box will propose the last known good value. So if no movements had been made since the failure started the old value can be taken to complete the account.***

### 5.4.7 Selecting a New Tank Detail

This option does not open a new window- it only replaces the Tank Detail with a new Tank Detail.

1. Select Window and click on Select... The Select Tank Point dialog box appears.
2. Highlight by clicking on the desired tank point and then click on Select.

***NOTE: More than one Tank Detail window can be opened at once by selecting Display and clicking on Tank Detail... from the Open Cascading Menu.***

## 5.5 Trending

Trending is the graphical indication of Tank Data (mostly volume or level data) over a timeline. The Software enables both Real Time Trending as well as Historical Trending. The trending enables the monitoring of a tank to consider near future operations. For the activation and definition of trends please refer the FuelsManager Software Handbook.

## 5.6 Trending

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# 6 ATG Application

The system operation is performed through different kinds of graphic screens.

- Tank Index Screens
- Site Overview Screens
- Tank Command Screens

## 6.1 Typical Examples for SCADA Screens

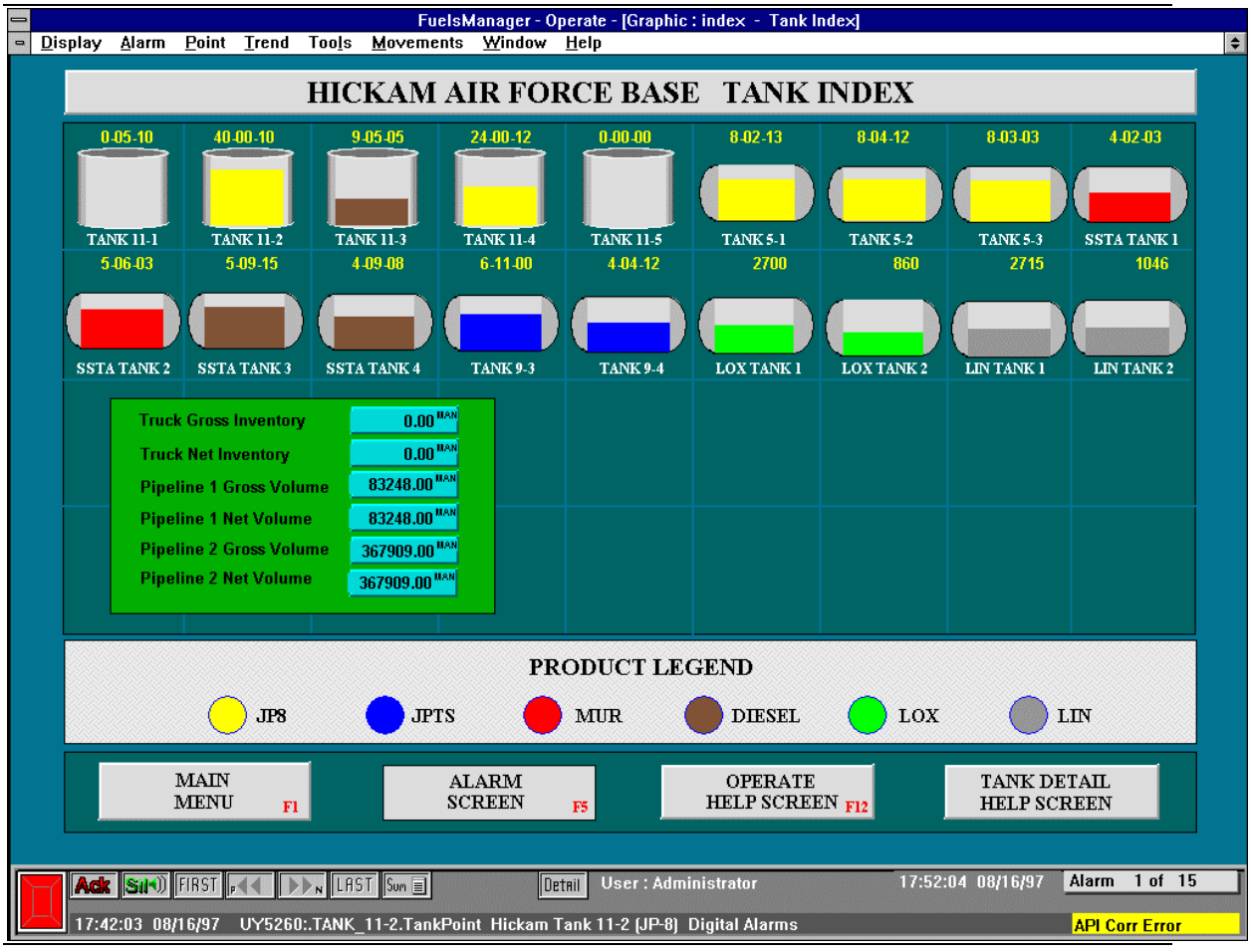


**Figure 15: Typical example for a Tank Index Screen providing access to all tank deatil** screens and the input of manually entered values.

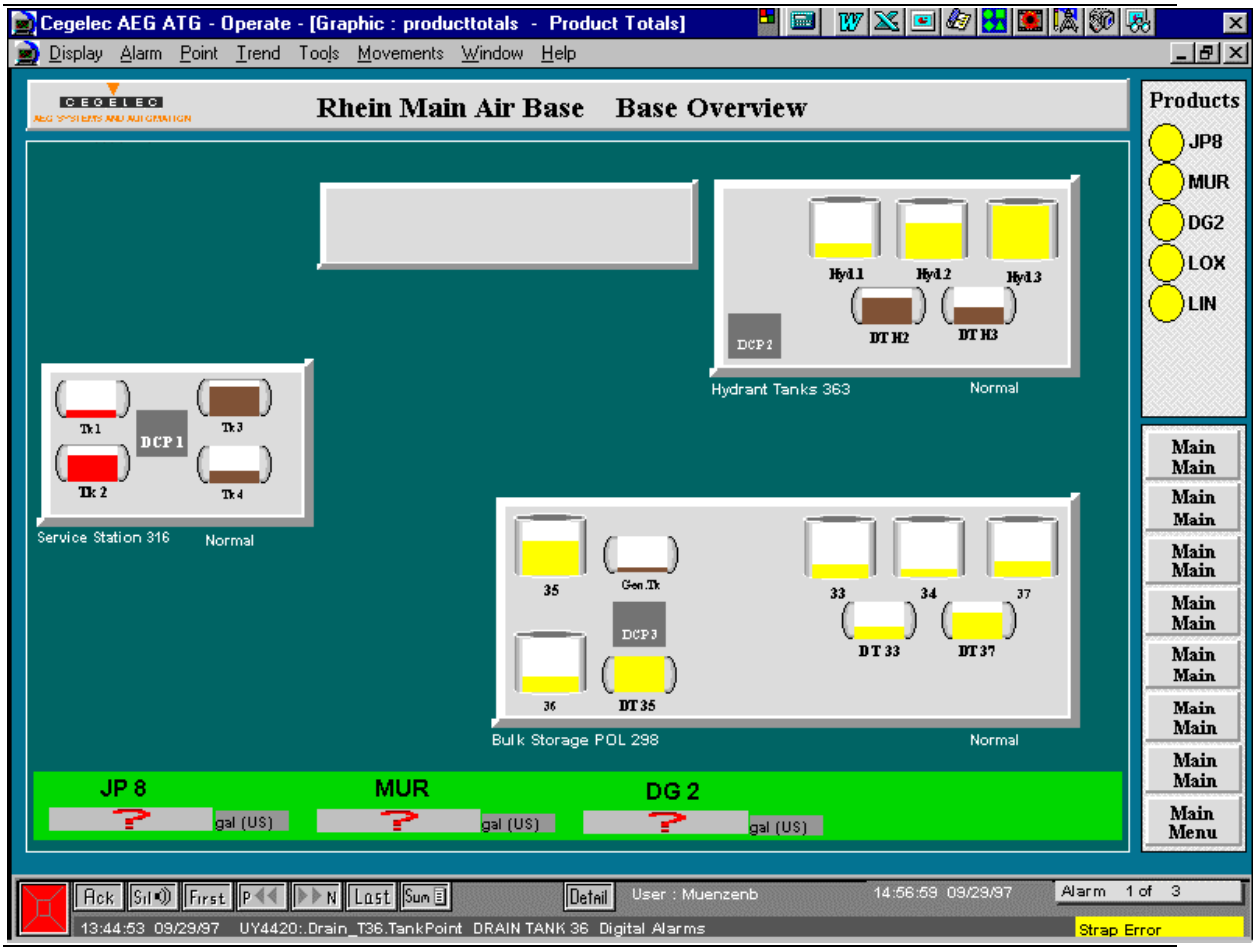


**Figure 16: Typical Site Overview**

Example of an Site Overview Screen providing access to all Data Collection Point graphics (if available).

## 6.2 Operation of the Servo Tank Gauges

The tank level is measured continuously. Some special data like water level in the tanks and density of the liquid inside the tank can only be measured by starting a command at the master computer at the FCC. The Servo Gauges may be operated using a specially designed window:

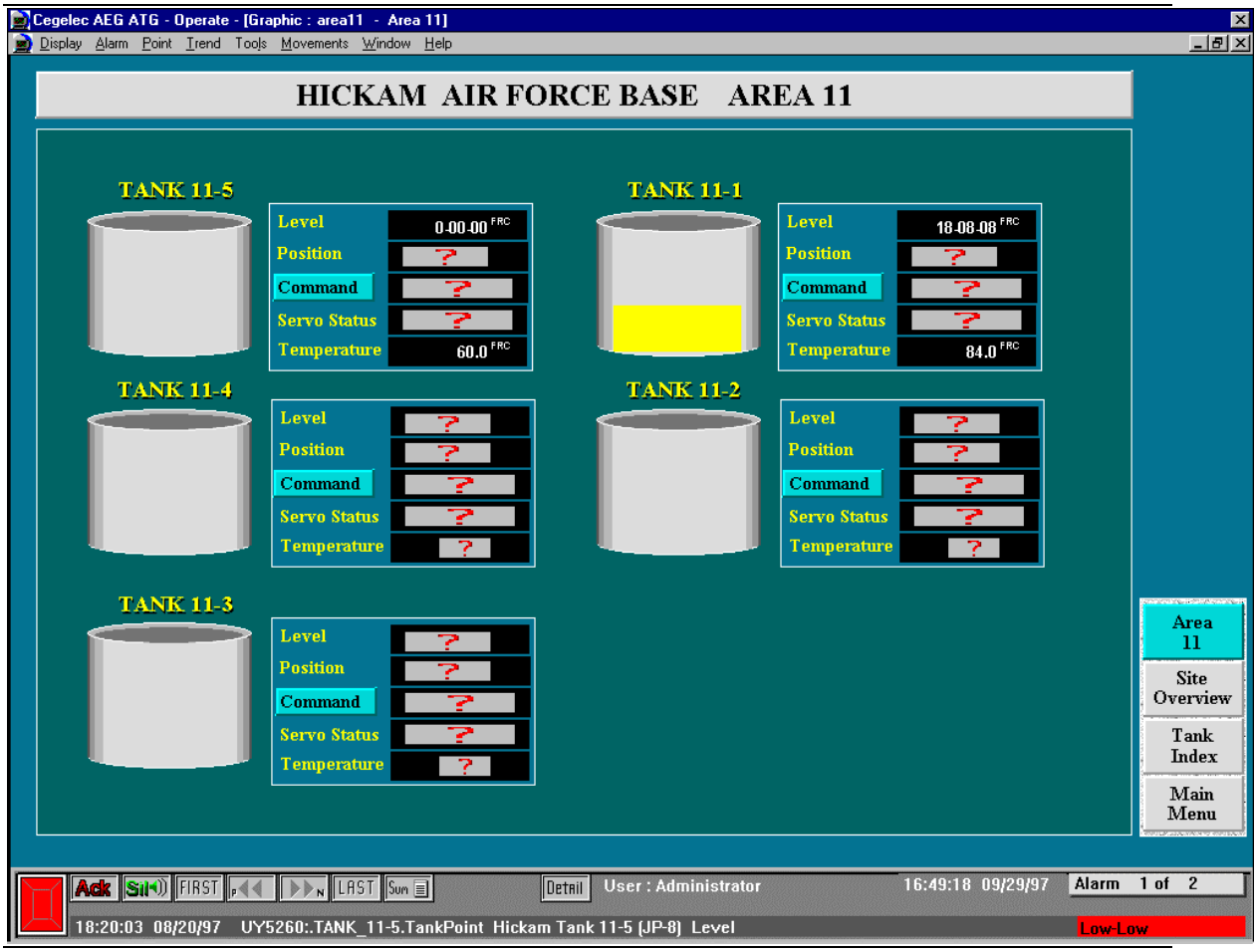


**Figure 17: Overview of all available Servo Gauge Tanks**

Each Tank symbol indicates the actual State of the Tank.

| *Indication* | *Description* |
|---|---|
| **Level** | Actual Fuel Level. If the Displacer Sensor is actually NOT measuring the fuel level, it is stored locally at the DCP. |
| **Position** | Actual position of the Displacer Sensor. |
| **Command** | Pop Up of a window to initiate Tank Gauge Commands. The Indication below shows the last given command through the SCADA Software |
| **Servo Status** | Actual Status of the Tank Gauge |
| **Temperature** | Actual measured Tank Temperature |

Initiating the Command Push-button provides a small Pop-Up to set the Tank Gauge into a different mode.

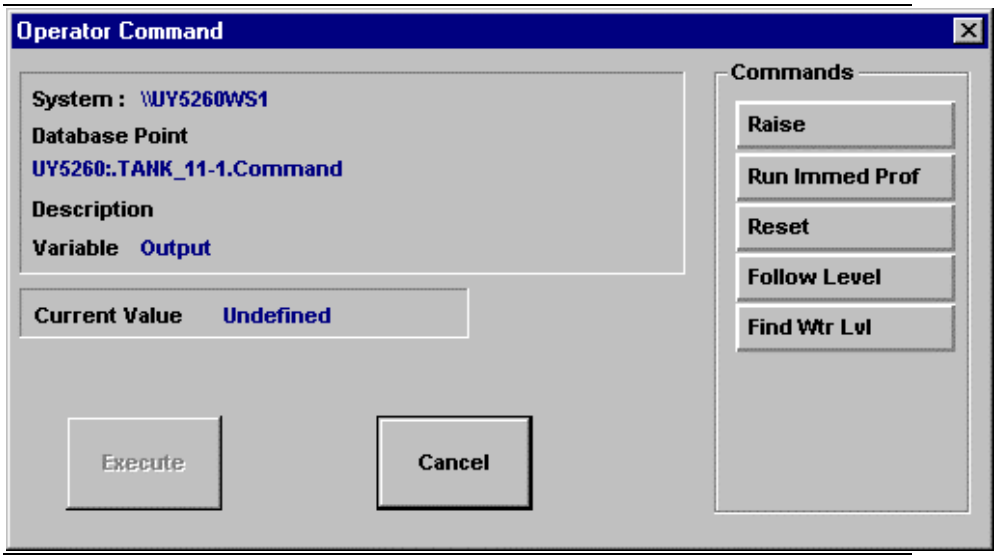


**Figure 18: Command screen for Servo Commands**

These Command are used to operate the Servo Tank Gauge. The possible Commands are:

| *Command* | *Description* |
|---|---|
| **Raise** | To lift the displacer to the top position of the movement range. Usually used if the stilling well is needed for manual sampling/gauging. The displacer will stay at this position until the operator gives another command. |
| **Run Immed Prof.** | Start a Density Profile Measurement. After finishing the Profile, the displacer will follow the level again. |
| **Reset** | To unlock the Displacer |
| **Follow Level** | To measure the actual tank level. |
| **Find Water Lvl** | Find Water Level. The Displacer lowers until it reaches the water interface level. Then it will follow the interface level until another command is initiated |

***Note: Actual product Levels will only be indicated when the Servo Gauge is in the "follow level" mode. If any other command is given, the last level reading will be displayed and the actual tank level is not monitored until the gauge is returned to the "follow level" mode.***

The indication below the command button indicates the actual state of the gauge, regardless where it was initiated (via the SCADA or locally). The

gauge state depends on the last given command either remote or locally. Every Command can be overwritten by the other location. Please ensure the proper function of the last given command.

The possible values for the Gauge State are:

| *Gauge Status* | *Description* |
|---|---|
| **Following Level** | The Gauge is measuring Level. All Level changes will show immediately |
| **Doing Profile** | Actually measuring the density profile. Fuel Level changes will not be recognized. |
| **Following Water Level** | The Gauge is measuring Water Interface Level. Fuel Level changes will not be recognized. This state will change only, if another command mode is selected. |
| **Blocked** | The Displacer has reached a Motor Limit Switch (usually at the Top Position). If status occurs during the "Find Water" command this is the indication that there is no water in the tank. |
| **Transitional** | The displacer travels within the tank to return to the follow level state. This state can last for 5-10 minutes, depending on the size of the tank. |
| **Finding Water** | The displacer travels from the fuel level down to the tank bottom to detect any interface level. This state is not permanent, it will change after some minutes to either "Blocked" or "Following Water Level". |

After the “Finding Water” command the gauge is active for approximately 10 minutes. For the density profile the gauge is active for approximately 45 minutes. Additional commands should not be entered until these activities are completed.

***ATTENTION: Be sure to start the measurement for water or density only for tanks which will not be filled or emptied during the needed profile time period, as no monitoring of the Fuel Level is possible during these measurements. Once the density profile has started it cannot be stopped by the operator.***

***Be sure that only authorized persons are able to start the command to prevent disturbances.***

The Tank Operation is locked during density measurement, if no other Tank Gauge is available and the Limit Switches are operated by the ATG System.

The command is for 1 tank only at the time, but it is possible to start the measurement for several tanks at the same time by selecting each tank.

### Density and Water Level Measurement for STIC Gauges (Type I Tanks)

The STIC gaige measures the Fuel Level, Water Interface Level and the Density continuously.

***The STIC value for the Water-Level may be different from the value obtained by manually sticking using water finding paste. The STIC Tank Gauge is more sensitive than the paste as it detects any emulsion of fuel and water. The STIC identifies these emulsions as Water.***

## 6.3 Tank Inventory Reports

Reports are selected by using the <F3> Button.

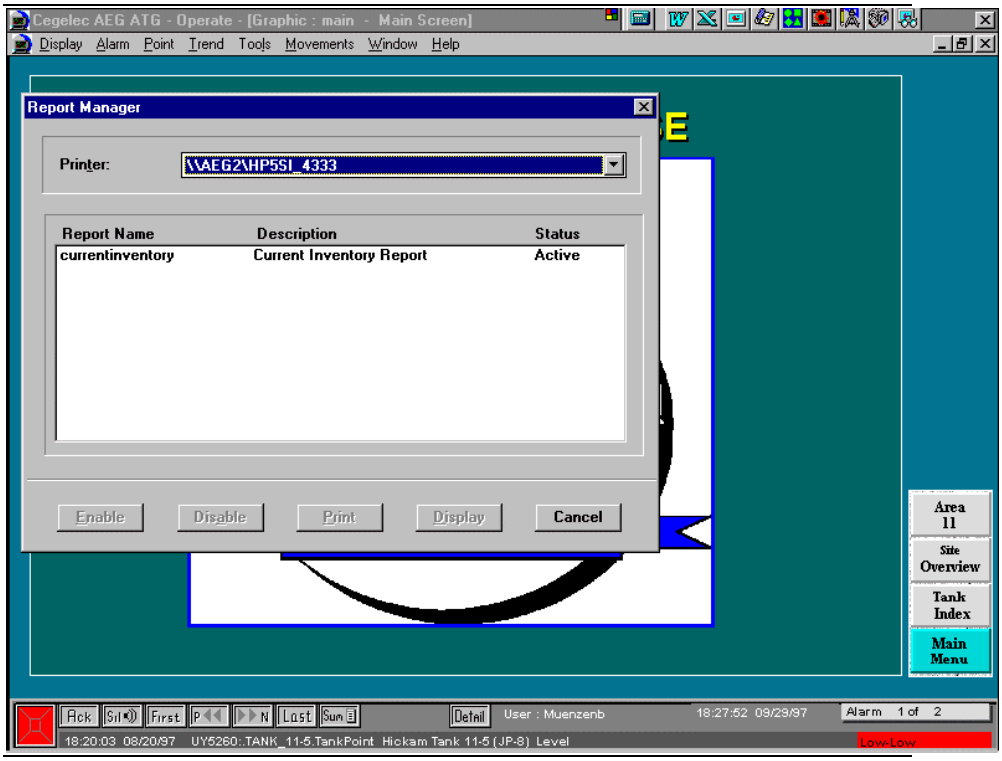


**Figure 19: Selection of an inventory report**

After selecting the report it can be either displayed or printed. A Report is the summary of all connected tanks sorted by the Fuel Grade.

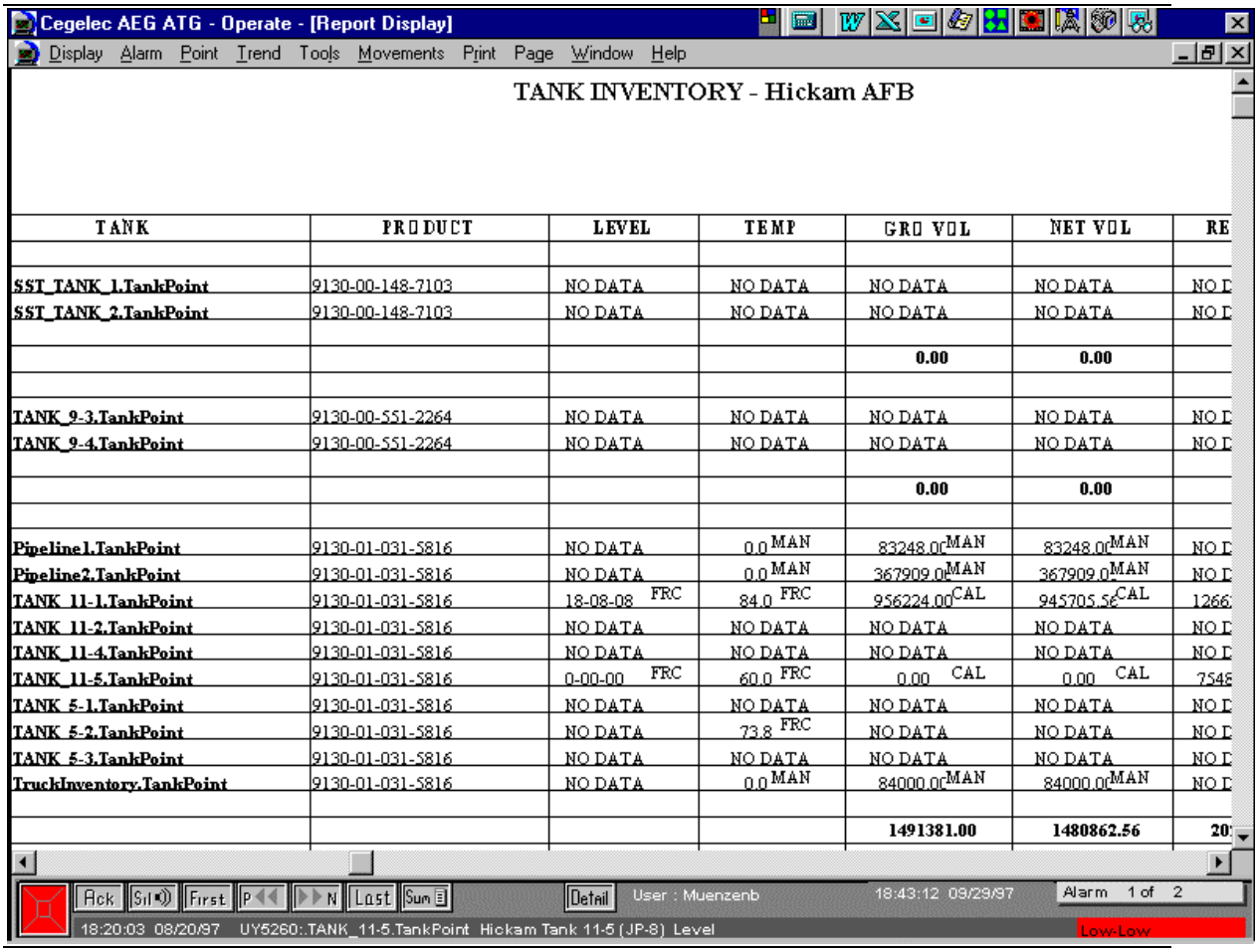


**Figure 20: Displaying an Inventory Report**

Additionally every hour the report is written into a file located on the Harddisk (\\name\project\REPORTS) where "name" is the designated Computer and "project" is the Directory name of the FuelsManager project.

Reports are named as: "_mmddyy_hhhh.prn" with
mm= month number,
dd= date,
yy= year
hhhh= hours in decimal 24h mode (0100 through 2400)

```
TANK                              PRODUCT            LEVEL      TEMP   NET VOL     REM VOL      AVL VOL     GRO
VOL
UY5260:.SST_TANK_1.TankPoint      9130-00-148-7103   3-05-01     88.7   4367.96      4277.11        4775.60
3482.98
UY5260:.SST_TANK_2.TankPoint      9130-00-148-7103   5-00-04     91.2   7003.23      6866.67        2198.06
6071.48
                                                                    11371.19       11143.77         6973.65
9554.46
UY5260:.TANK_9-3.TankPoint         9130-00-551-2264   6-10-15     84.7   14988.24     14988.24       3005.23
4910.12
UY5260:.TANK_9-4.TankPoint         9130-00-551-2264   4-04-05     85.6   5855.75      5855.75        1188.93
2893.84
                                                                    20843.99       20843.99         4194.16
7803.95
UY5260:.Pipeline1.TankPoint        9130-01-031-5816   NOTINIT     0.0    83248.00     83248.00       INVALID
INVALID
UY5260:.Pipeline2.TankPoint        9130-01-031-5816   NOTINIT     0.0    367909.00    367909.00      INVALID
INVALID
UY5260:.TANK_11-1.TankPoint      9130-01-031-5816  0-05-10    0.0   39235.00    40718.08     2306821.75 0.00
UY5260:.TANK_11-2.TankPoint        9130-01-031-5816   36-08-08    84.1   1871214.00 1848385.25   386914.34
1490820.38
UY5260:.TANK_11-4.TankPoint        9130-01-031-5816   28-09-10    83.8   318928.00    314973.31      87260.39
239298.45
UY5260:.TANK_11-5.TankPoint      9130-01-031-5816  0-00-00    0.0   154.56      160.40       761288.31  0.00
UY5260:.TANK_5-1.TankPoint         9130-01-031-5816   8-02-08     85.1   43312.37     42757.97       2611.76
37821.97
UY5260:.TANK_5-2.TankPoint         9130-01-031-5816   8-04-10     73.8   44138.89     43825.50       3320.86
37520.59
UY5260:.TANK_5-3.TankPoint         9130-01-031-5816   8-02-14     85.5   43527.36     42965.85       3208.22
36898.64
UY5260:.TruckInventory.TankPoint9130-01-031-5816    NOTINIT     0.0     90000.00     90000.00       INVALID
INVALID
                                                                    2901667.18    2874943.38      3551425.64
1842360.04
UY5260:.SST_TANK_3.TankPoint       9140-00-000-0184   5-08-14     89.4   8066.21      7943.61        1160.87
7144.93
UY5260:.SST_TANK_4.TankPoint       9140-00-000-0184   3-11-05     89.2   5244.79      5180.80        3951.41
4379.69
UY5260:.TANK_11-3.TankPoint        9140-00-000-0184   9-00-02     87.1   38796.00     38272.25       50533.46
8474.04
                                                                    52107.00       51396.66         55645.75
19998.66
```

**Figure 21: Example for an hourly report file.**

***Attention: Each report file allocates approximately 2,5 Kbytes Hard disk space. Please ensure that the oldest files will be deleted after they are no longer needed for historical purposes. As 24 files are written every day, the required space is 60 Kbytes per Day or 21,5 Mbytes per Year.***

# 7 Trouble shooting and first aid

## 7.1 Explanation of Alarms (extract)

### High, Low, High-High, Low- Low

Level Alarms, caused by the tank level moving over the respective level.

### Movement Alarm

Occurs, if the Tank State is set into "Stop". Indication and Log entry only.

### API Corr Error

Occurs, if the transmitted measured value is out of range.

### Off Line

The communication between the main computer and the DCP stations is controlled all the time by sending and answering a signal. If the signal is not responded within a period of time (i.e. 2 minutes) for 4 cycles the alarm will be generated. If the communication works again, the message will disappear, but the alarm has to be acknowledged.

### OverRange, UnderRange

May occur on Input / Output failures. Check cables

### Scan Failure

Happens, if the connection between the DCP cabinet and the servo gauges is disconnected or the gauges are switched off with the fuse.

### Trans Adv SetPt

Alarm generated if approaching the pre-set Advisory setpoint. No further action required.

### Donator Flaw / Alarm

The message occurs, if the receiver of the tank gauge detects an error at the gauge.

## 7.2 ATG Main Computer at the FCC

### No data from any DCP are indicated, indication "Off-line"

a) After switching the system on; it takes about 5 minutes until all data are collected from the DCPs during this period of time no data are indicated unless the menu system is active.

b) Sometimes atmospheric disturbances may occur. These disturbances should not take longer than 5-10 min.

c) If the alarm is active for more than 15 minutes check the DCP station (power supply etc.). if ALL DCPs are disconnected, check the radio at the FCC, otherwise at the DCP cabinet.

### System reacts very slowly to operation commands

a) This may occur if too many slaves are logged in via Ethernet.

### Computer does not start

a) Check, if a Floppy diskette is inserted at the disk drive.

b) Check the state of the LEDs at the frontside of the computer (see chapter "ATG Main Computer")

c) Maybe the computer is active, please wait approx. 5 minutes until the program started completely.

d) Check the screen contents, if any failure is indicated. In this case write down ALL messages and confirm with the designated button.

## 7.3 Measured Values for Type I (horizontal) Tanks

### Density for horizontal tanks not changing any more

This is no system failure.

The density in those tanks is measured by two probes in 3 feet distance starting 1 feet above the tank bottom. If the tank is close or below 4 feet fuel level, the last known good value is frozen, until the tank is filled again.

### Density for horizontal tanks too high (API values too small, API correction error)

Either one of the pressure probes, or the density receiver at the DCP for the respective tank is broken. Probably a red light is indicated at the front of the receiver. Service required.

### Density for horizontal tanks too low (API values too high, API correction error)

This might happen if the probes are not covered by fuel and the power fails. The error disappears after the refill of the tank.

### Level for horizontal tanks too high (32', 9", 11/16$^{th}$)

STIC probe is either disconnected from the ENRAF receiver or defective. Check cabling connections.

## 7.4 Measured Values for Type II (vertical) Tanks

### Water is indicated, although not expected (no tank refilled)

This could happen after a "water Find" command, if something is laying below the Servo gauges installation flange. Please raise the displacer again (5-6 feet above tank bottom) and try again. If still water is indicated, this can be considered to be correct.

### Displacer travels down 1 feet after raising to Top Level

To enable a manual gauging of the tank, the displacer has to be moved to the top of the tank. After releasing it to return to the fuel level it is supposed to go down directly. Under special circumstances it may stuck at the top

level (or 1-3 feet below) indicating an unreasonable fuel level. In this case please raise it again and lower it until it reaches the fuel level. The reason is a barrier reducing the weight of the displacer